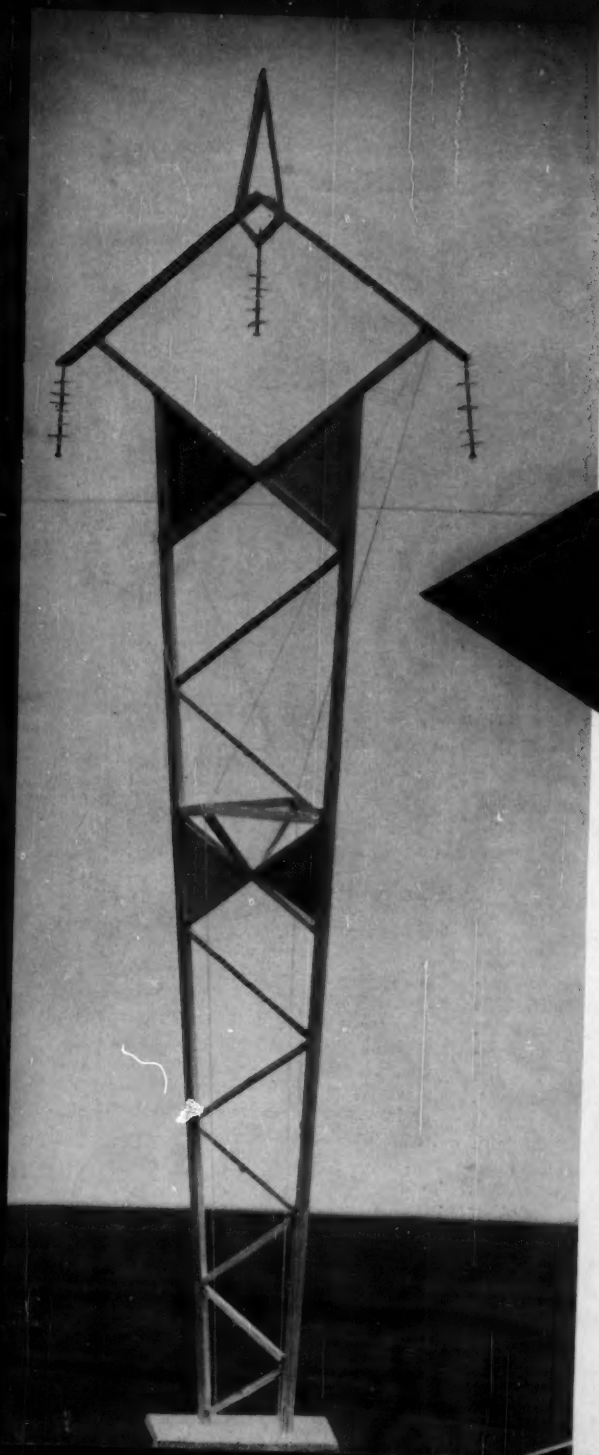
Electrical World



Transmission Tower

.....page 62

Winter Peak Falls Short of Estimate by 2½%

. . . page 44

E B POWER GS W 12
UNIVERSITY MICROFILMS IN
313 N 1 ST
ANN ARBOR MICH

DESIGN OF WORLD'S LARGEST STEAM TURBINE is discussed by General Electric Vice President G. B. Warren (center), and Large Steam Turbine-Generator Dept. Engineers R. Shepherd (left), and C. W. Elston. Cross-section drawing of 450,000-kw unit is shown in background.

What is the turbine of tomorrow?

Advantages of cross-compound units herald new design trend . . . Case in point: 450,000-kw six-flow unit

It is apparent that rapid growth of the utility industry will continue to create a demand for millions of kilowatts of steam turbine-generators. More frequent demands for larger blocks of power have led to the development of larger turbine-generators. This fact is spurring the trend toward cross-compound units because of the inherent advantages of this design for very large ratings. An interesting example is General Electric's new 450,000-kw cross-compound turbine-generator.

WORLD'S LARGEST

This is the largest unit now being built in the world. Operating at initial steam conditions of 3500 psi and 1050 F, its thermal cycle efficiency will be substantially better than any other unit now in commercial operation. The new giant power maker will be a double reheat, 3600/3600 rpm cross-compound, six-flow turbine-generator with 50/50 load split. This design allows duplication of generators, exciters, transformers and electrical buswork, which leads to savings in initial engineering and construction of the plant. Duplication of foundation structure is possible for a very large part of both primary and secondary shafts. Placement of the high-pressure section on one shaft and the first reheat section on the other shaft provides additional space for routing of the high-temperature piping under the foundation.

FUTURE APPLICATIONS

Looking beyond this advancement, General Electric engineers are applying the knowledge and experience gained from the design and construction of this unique turbine to even more efficient machines in the not too distant future. Such engineering know-how will help offset the trend of rising construction and operating costs, because these large, efficient units reduce plant volume per kw of capacity. For information about General Electric Steam Turbine-Generators, contact your General Electric Apparatus Sales Office. General Electric Company, Section 301-319, Schenectady 5, N. Y.

LIVE BETTER ELECTRICALLY

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Vol. 147, No. 2 Jan. 14, 1957

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Cable splices made faster, last longer in toughest "proving ground" here in The Bessemer Limestone and Cement Company's quarrying operation. Note the rough surfaces over which the cable is dragged. Under conditions that vary from extreme dryness to complete submersion, Bessemer reports exceptional results from the rugged splices made with Okonite Tapes.

Okonite Tapes reduce down-time for Bessemer shovels

The Bessemer Limestone and Cement Company has reduced down-time on its electric shovels two ways by using Okonite Tapes in splicing its high voltage portable shovel cables. First, tough, waterproof splices can be made in the field without taking the cable to the shop and without buying any special molds and other equipment. Second, splices made with Okonite Tapes have been in service since 1948 without added time-loss in remaking.

Cables and splices are dragged over rocks, frequently lie completely submerged in water, and are constantly exposed to sun, rain, snow and ice. Yet Okonite splices have maintained their waterproof toughness for seven years of this treatment. No wonder Bessemer has standardized on Okonite Tapes.

Each splice is designed to give maximum electrical and mechanical protection for operation at 4160 volts. Okolite Corona-Resisting Tape fuses into a solid wall of self-vulcanizing high voltage insulation. Over the shielding tape applied about the three-conductor core, a solid wall of Okoprene Weather-Resistant Tape gives full neoprene protection to the splice. This combination of Okolite and Okoprene Tapes provides the toughness and complete moisture resistance necessary for continued service under such severe operating conditions.

Specify Okonite tapes for the tougher jobs. Get them from your Okonite Tape Distributor, or write to The Okonite Company, EW Tape Department, Passaic, New Jersey.

Available Through Authorized Distributors Only.

OKONITE

splicing tapes

3522-A

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. . . from the publisher

Recently I had the pleasure of meeting a smart, engaging young 17-year-old boy now studying in Geneva. He also happens to be Peter Sprague, son of Julian K. Sprague, president of Sprague Electric Co.

Young Peter had just returned from a spur-of-the-moment trip into Hungary during the height of the revolution. He came out of Hungary after spending several days with the rebels most of whom were about his age. He was also a prisoner of the Russian army for two days. During this period he acted as scavenger for food and fuel for the other prisoners.

But Peter came out with an illustrated story which he sold to his home town paper.

This is not an entirely typical story of young Americans. But it is typical to the extent that it shows the tremendous energy and enthusiasm of our young men. And it provides a good indication that youth retain the pioneer spirit of our ancestors.

Our young editors on Electrical World have these characteristics, and they also have a healthy discontent with things as they exist today. That's why we have a new contents page. Our young editors couldn't stand the old one.

"Why should our readers have to work so hard," they asked with youthful impatience. "Why not make it as easy for them as possible?"

With this in mind they reworked the entire contents presentation, pinpointing each article to your particular interests. The result: Easier-to-get-at stories and faster reading for you.

Their handiwork appears on page 3. We hope you like it.

Fischer Black

ELECTRICAL WORLD

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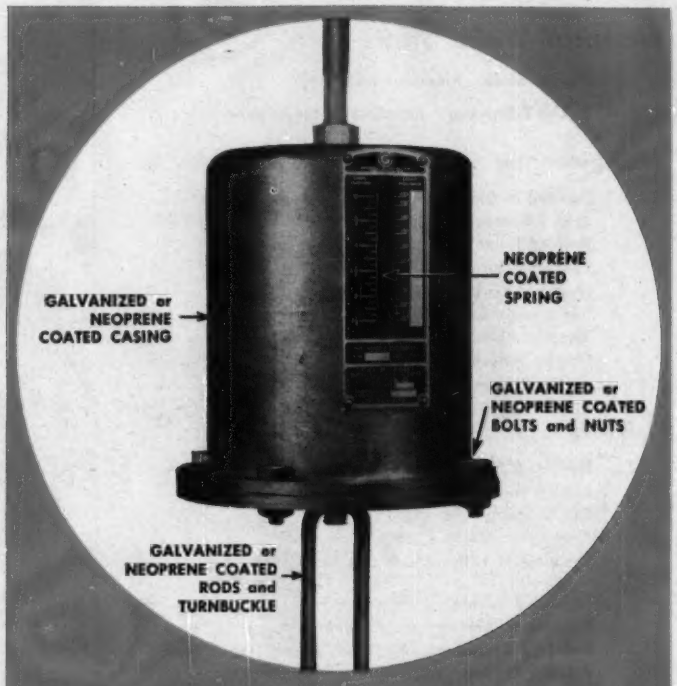
NEW

weather-resistant, corrosion-resistant

GRINNELL VARIABLE SPRING HANGERS...


GALVANIZED or NEOPRENE COATED CASING
NEOPRENE COATED SPRING
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GALVANIZED or NEOPRENE COATED RODS and TURNBUCKLE

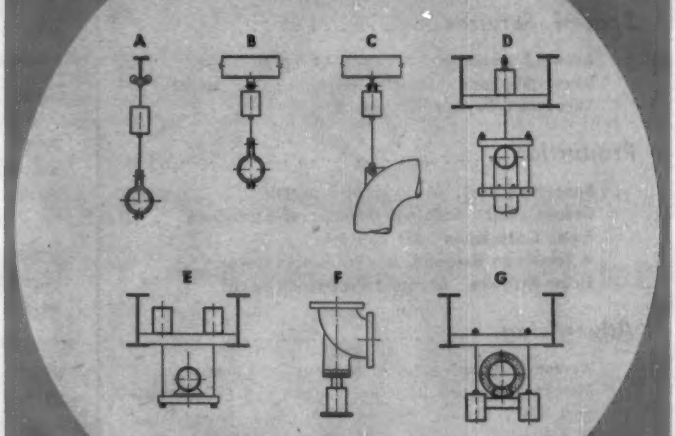
Another Grinnell First!

Grinnell pre-engineered spring hangers are now offered in two new lines to meet the need for spring hangers in installations subject to highly corrosive industrial conditions and to severe weather exposure.

These hangers are the result of extensive experimentation with various coatings for Grinnell's standard pre-engineered spring hangers. In addition to providing flexibility in pipe suspension, they provide versatility of application through their corrosion-resistant characteristics. They are . . .

1. Neoprene coated – for highly corrosive conditions such as those found in chemical plants and refineries. *All* parts of the hanger are neoprene coated to protect the base metal from a wide range of corrosives. The flex life of the spring is unaffected by the neoprene . . . the coating resists cracking or flaking over a wide temperature range.

2. Galvanized – for outdoor installations where weather conditions are severe. All parts of the hanger are galvanized except the spring, which is neoprene coated to avoid alteration of temper, hydrogen embrittlement and decreased flex-life of the spring – usual hazards to springs from the galvanizing process.



(A) Rod threaded to top cap (B) Furnished with single lug (C) Two lug style (D) Top adjusting (E) Adjustable top and bottom (F) For floor support (G) Trapeze assembly.

GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Along with the obvious advantages of such corrosion and weather-resistant characteristics, consider these features...

- Maximum variation in supporting force per ½" of deflection is 10½% of rated capacity – in all sizes.
- Precompression* assures operation of spring within its proper working range, as well as saving valuable erection time. Reduced over-all height saves space.
- 18 sizes available from stock for load ranges from 53 lbs. to 12,000 lbs.
- Available in 3 spring lengths for travel ranges of 1¼, 2½, and 5 inches.
- Installation is simplified by integral load scale and travel indicators.

*Precompression is a patented feature.

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

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To do his job well, your lineman needs the finest and most reliable equipment obtainable. And, for more than 85 years Graybar has supplied only the lines of tools, supplies and equipment best-suited to his needs.

Made by over 200 of the nation's leading manufacturers, they're all products your linemen know and respect — famous tool lines, for instance, like Klein, Simplex, Adams, Salisbury, Oshkosh, Coffing, Chance and many others.

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Also, because Graybar is owned entirely by its operating and retired personnel, you can always expect an extra measure of personal interest when they serve you.

Call Graybar for LINEMAN'S TOOLS

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Now Balanced Design in Allis-Chalmers

Engineered to provide all the advantages you want and need

In the *balanced design* of Allis-Chalmers power transformers, each feature complements the others to provide outstanding dependability and long transformer life.

High Impulse Strength — Coil assemblies are designed to withstand repeated lightning and switching voltage surges without damage to the transformer.

Corona-Free Design — Keeps transformers young. Full insulation strength is maintained because transformer parts are kept free of corona's injurious effects.

Quiet Operation — Constant research in transformer noise has led to reduced sound levels in Allis-Chalmers transformers.

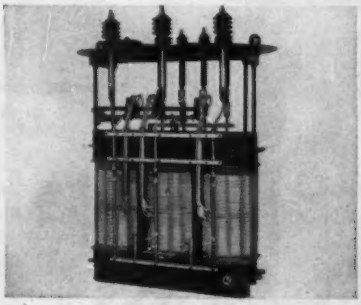
Reduced Size and Weight — Substantial reductions in height and weight simplify installation and relocation. Larger units can be shipped completely assembled.

High Short-Circuit Strength — In Allis-Chalmers transformers, circular coils are preshrunk and rigidly braced to withstand short-circuit conditions. Careful electrical balance of windings minimizes mechanical forces.

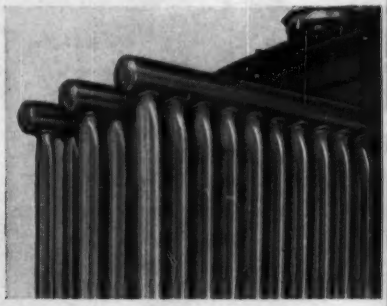
Get the complete "balanced design" story from your Allis-Chalmers representative. With a vast background of application engineering experience at his disposal, he will be glad to discuss transformer problems with you. Call your nearby Allis-Chalmers office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Mechanical Strength...

One of the Many "Engineered-Together" Features of A-C Small and Medium Power Transformers



Side frame design locks core and coil assembly firmly to protect against short-circuit forces. Machine-wound insulating tubes provide rigid support for leads.

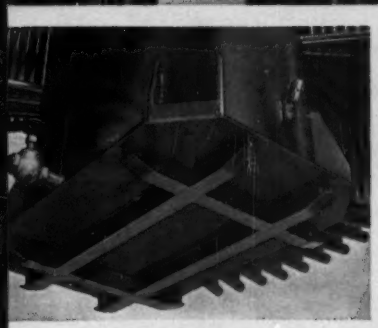


Radiator assembly is welded into tank wall to provide neat appearance and strong construction. Gasket maintenance is eliminated.

LIVE BETTER ELECTRICALLY

ALLIS-

Power Transformers



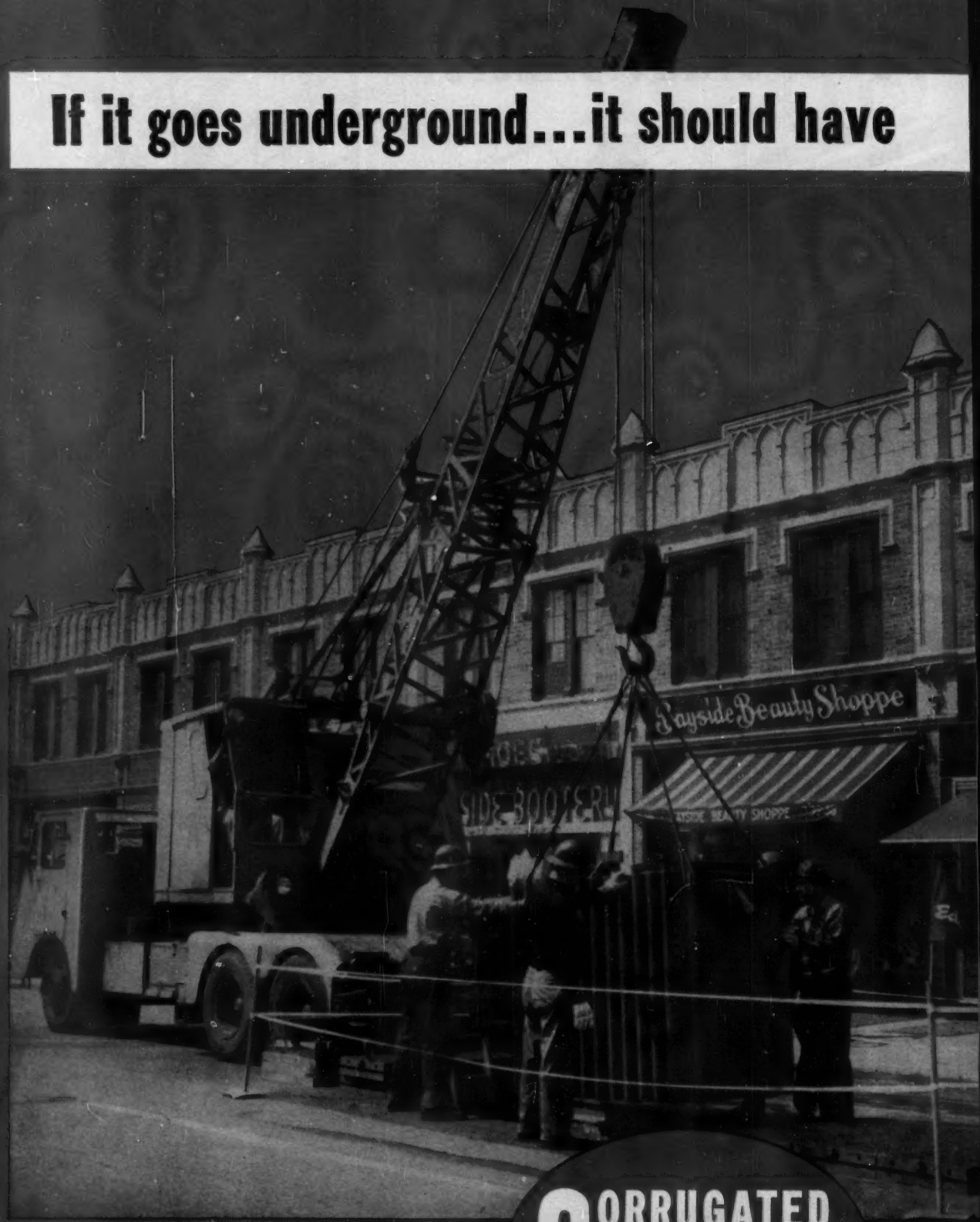
New base combines strength with utility. Heavy I-beam supports are turned upward at ends to allow sliding or rolling of transformer in any direction.

CHALMERS

A-C ALLIS-CHALMERS

A-5149

If it goes underground...it should have



Men lowering a 500-kva Pennsylvania Corrugated-Cooled Network Transformer into a street vault.

CORRUGATED COOLING

CORRUGATED COOLING

featured in PENNSYLVANIA SUBWAY-TYPE NETWORK TRANSFORMERS

In Pennsylvania Network Transformers, radiating chambers in corrugated form replace conventional tubes and radiators. The result is a tank with straight, smooth, vertical surfaces — a tank easy to clean, easy to paint; a tank designed with your maintenance problem in mind.

That's why Pennsylvania Corrugated-Cooled Network Transformers are easiest of all to maintain in subway vaults, where tanks, and particularly tubes and radiators, can be eaten away at a rapid rate by the corrosive action of water, sludge, salt, and sewage.

Since all four sides of the corrugated tank are completely vertical, there are absolutely no hidden or hard-to-get-at places. Thus, all four tank walls can be thoroughly cleaned and even painted from above the transformer. For even further protection, cases, covers, and tank bottoms are fabricated of Cor-Ten steel, which has an inherent resistance to corrosion that is two to three times better than that of copper-bearing steel.

You'll want to know more about Corrugated Cooling. A letter addressed to Ira Horne, manager of Pennsylvania Transformer Company's power sales department, will bring a fast reply.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division **CANONSBURG, PA.** Greater Pittsburgh District

Small size and low height of Corrugated-Cooled transformer permit installation of larger ratings in small vaults.

Men fasten I-beam into position into wall recesses for suspension mounting of Corrugated-Cooled transformer.

John Harrell, Manager Voltage Regulator Sales, points out that URL-16 feeder regulator with new CVR relay and instant-response Geneva gear tap changer combine to offer superior regulation with less maintenance.

Westinghouse 16-step regulation means you carry greatest load, produce most revenue

URL-16 with new CVR relay performs three exclusive functions:

1. FASTER CORRECTION OUTSIDE SET BANDWIDTH

The new CVR relay designed with inverse time characteristics actually evaluates the need for speed of response . . . steep voltage variations are corrected more quickly than gradual voltage changes. Result —a narrower effective bandwidth.

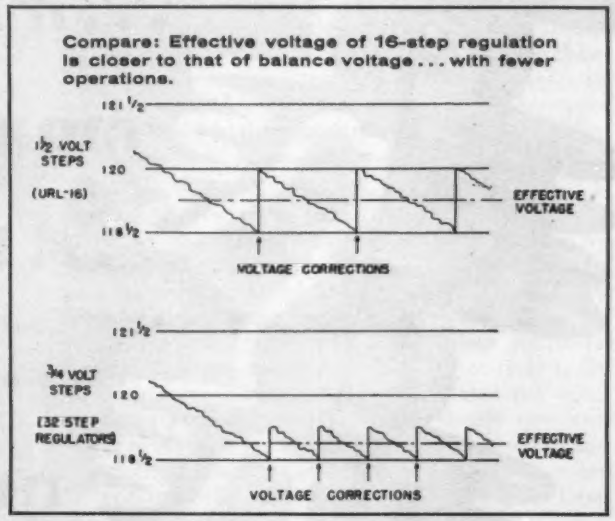
2. INSTANT-RESPONSE TAP CHANGING

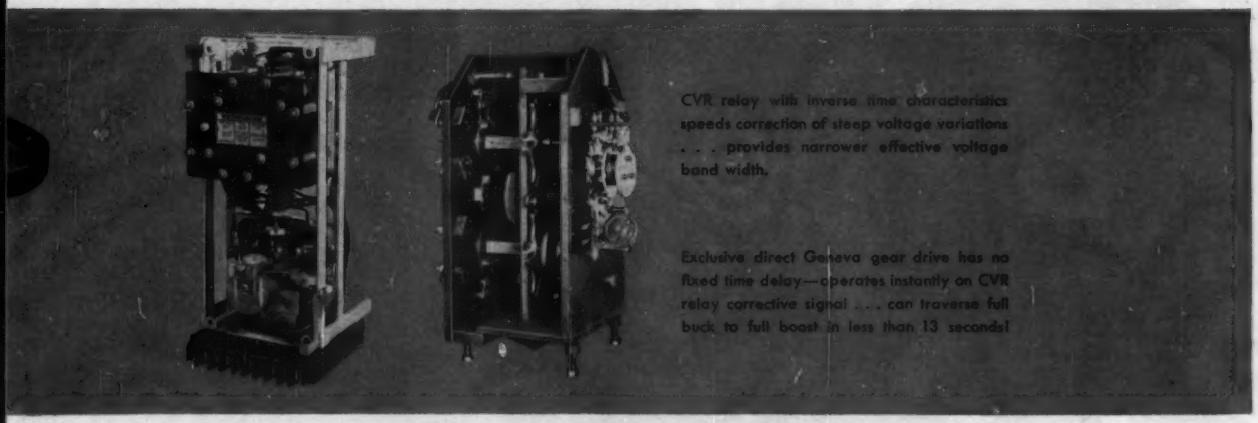
Because of direct Geneva gear drive there is no fixed time delay between relay and tap-changer operation. Tap changer operates instantly . . . can traverse full buck to full boost in less than 13 seconds!

3. 16-STEP REGULATION

The exclusive URL-16 with 1½-volt steps corrects exactly to balance voltage on a 3-volt bandwidth bringing the effective voltage nearer to this level. Similarly, the higher correction on 2-volt or greater bandwidth results in effective voltage closer to the desired level. URL-16 slashes number of corrective operations by 42%, contacts erosion 15%. Result—substantial savings in maintenance.

A narrower effective bandwidth means you can put more load on your system . . . get more revenue for power delivered. Specify new Westinghouse URL-16 regulators on your system. J-70779-X



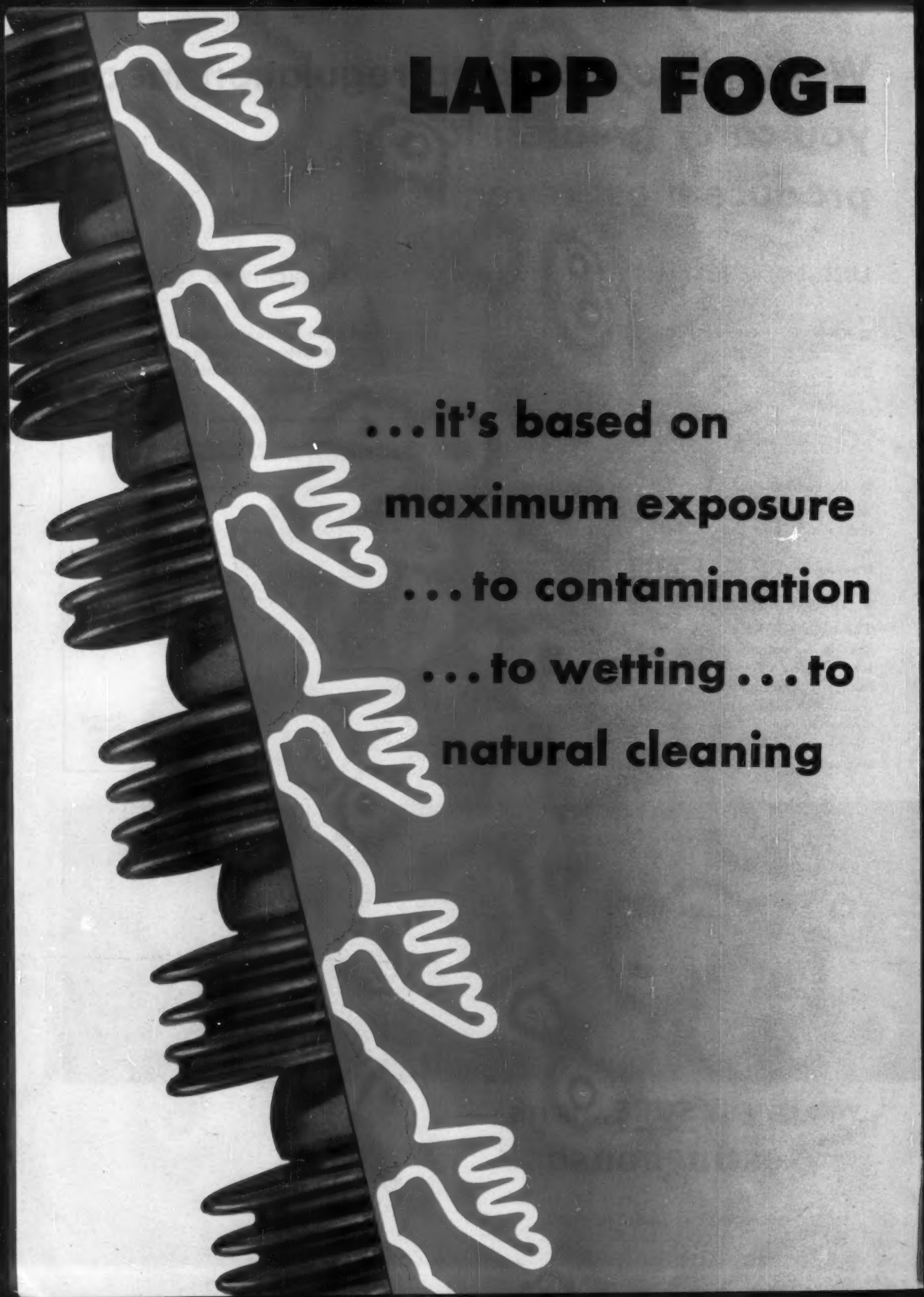


CVR relay with inverse time characteristics speeds correction of steep voltage variations . . . provides narrower effective voltage band width.

Exclusive direct Geneva gear drive has no fixed time delay—operates instantly on CVR relay corrective signal . . . can traverse full buck to full boost in less than 13 seconds!

YOU CAN BE SURE...IF IT'S

Westinghouse


LAPP FOG-
...it's based on
maximum exposure
...to contamination
...to wetting...to
natural cleaning

TYPE DESIGN

Nobody wants power arcovers. They cause service interruptions, set fire to equipment, add to maintenance costs, and pull line crews out of bed on foul nights.

But power lines do have to run through areas where dust, salt-spray, chemicals—even automotive exhaust fumes—combine with fog or rain to coat insulators with a conductive material such that leakage flashover can occur unless special steps are taken to avoid it.

The "special steps" begin, usually, with increasing the length of leakage path. The distinguishing characteristic of every "fog type" design is the extra inches of leakage distance it provides.

Dozens (maybe hundreds) of insulator designs have been produced for operation under contaminated atmospheric conditions. All have had extra leakage distance, but few have merited a second order by a user. So it must be that the geometry of the increased leakage surface has something to do with its effectiveness.

There is one design that has been successful. It has a record of more than thirty years on this job and has generally been adopted for all types of porcelain insulators for outdoor service.

This is a brief story of the technical considerations back of this design and of the reasons why it can save you money by reducing insulator cleaning, avoiding outages, and providing more dependable operation than is possible with any other type of insulator.

The effect of any contaminant, spread over all or part of an insulator surface, is to lower the surface resistance, thus allowing more leakage current to flow.

It is here that most errors occur in the thinking about contamination problems. Most people, at first thought, consider leakage current bad—that it should be prevented from flowing. As a matter of fact, however, it is the leakage current that saves the insulator, because it is continually drying and correcting the low resistance which fog or drizzle has caused.

Variations in thickness, width of path, and wetness in various areas of the surface result in non-uniform leakage surfaces. These variations are caused by the cleaning action of wind and rain, by non-uniformity in width of surface, by shielding parts of the surface from rain. When rain falls on a dirty insulator, resistance of the wet part is lowered. Since the total resistance is reduced, more current flows, but this current dries the shielded high-resistance areas even more rapidly. Thus voltage piles up over these high-resistance sections, showing increasing fire and arcing, precipitating flashover.

It's the dry, high-resistance areas of insulator surface that start flashover, and any attempt to shield insulators, or parts of them, is to invite flashovers by creating "hot spots" which initiate the flashovers.

The Lapp principle of Fog-Type design seeks uniformity and tries to obtain this uniformity by maximum exposure—to contamination, to wetting, to natural cleaning by wind and rain. It is typified by short petticoats, spaced to avoid pockets where contamination and moisture can accumulate. In the suspension unit, the smooth underside is also designed for maximum exposure with no restricting baffles to prevent cleaning. Spacing of petticoats is designed to obtain natural cleaning from water flow and splashing from below.

In most areas, no cleaning of Lapp Fog-Type insulators is required. Where a program of maintenance cleaning is necessary, time intervals for cleaning Lapp units may be extended beyond that required for other types of insulators, and the fully exposed leakage path makes such cleaning easy, fast, and economical.

The merit of this principle, and of the design, is confirmed by the service record of Lapp Fog-Type units. Those we ship today look just about like those we produced thirty years ago, and users of these thirty-year-old units have had little reason to look for new concepts of fog design. In the years since, the principle has been adapted to many types of outdoor insulators. Identical fog-type corrugations, used extensively today for high voltage bushings, have obsoleted the wide, spreading petticoats which were previously standard. Major advantages in performance, both mechanical and electrical, of Line Post and Station Post insulators are derived from the adoption of these designs of Lapp Fog-Type corrugations.

You improve the service record of your system, save your company maintenance expense, and improve the sleeping habits of your line crews every time you build a line on Lapp Fog-Type insulators.

Lapp Insulator Co., Inc., Le Roy, N. Y.

NEW
TAPIT with
STRIPSEAL
PROCESS

For the first time a clamp type connector factory-filled with oxide inhibiting compound. Now you can be *sure* your aluminum connections are being properly made. Installation forces the compound around and between aluminum cable strands —breaks the oxide film, affords more even distribution of current throughout the joint. For more information, write Burndy, Norwalk, Connect.

***STRIPSEAL* — for an oxide seal!**

BURNDY

S6-11

Norwalk, Connect. • Toronto, Canada • Other Factories: New York, Calif., Toronto • Export: Philips Export Corp.

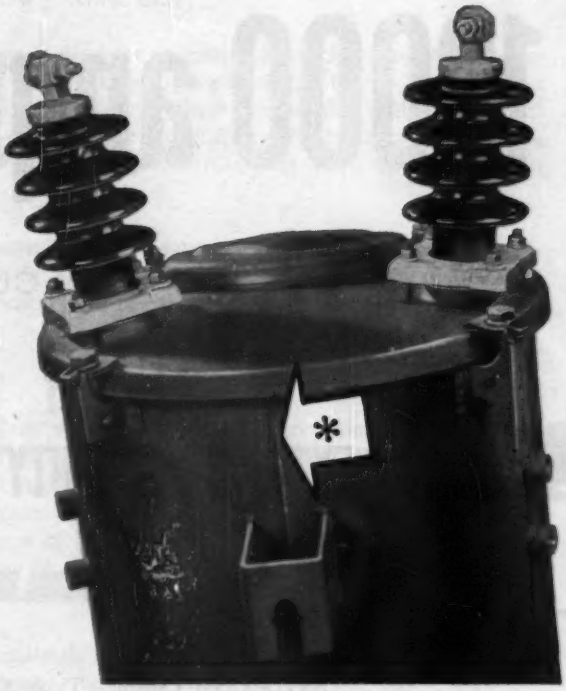
KUHLMAN *"Salesman of the Week"*

If you can identify this Kuhlman Electric Co. representative, and are the first one to notify Dept. SA-1, Kuhlman Electric Co., Bay City, Michigan, you will receive a valuable gift certificate. Each week a different Kuhlman representative is featured . . . watch for the Kuhlman salesman who calls on you.

"LET ME SHOW YOU WHY

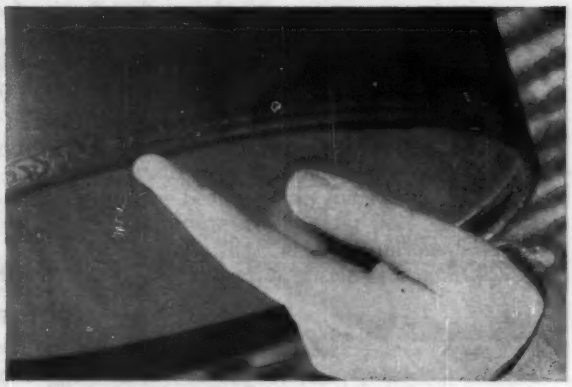
KUHLMAN TRANSFORMER TANKS ARE YOUR BEST BUY . . . . . ."

In my territory a distribution transformer tank must be leak-proof . . . air-tight . . . and rigid in construction. That's why my customers consistently order Kuhlman. They know every weld and seam of a Kuhlman tank has been factory-tested, under pressure, for oil tightness. And for all around service, they prefer Kuhlman's solid construction—moisture-proof cover fitting—and rounded tank bottom features. It will pay you to talk to your local Kuhlman representative about all the features that make Kuhlman distribution transformers your best buy.



* All welds, seams PRESSURE-TESTED

SPUN-OVER RIM—increases tank rigidity. Forms a smooth gasket seat for a moisture-proof, air-tight cover fitting.



ROUNDED BOTTOM—provides added tank strength . . . sheds moisture easily . . . forms a rugged bearing surface for handling and shipping.

575b

KUHLMAN ELECTRIC COMPANY

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

Now...clear 12000 amps

WITH AN OPEN CUTOUT

AT ONLY "EXTRA HEAVY DUTY" COST

S&C's Open Cutout—Type XS—with a newly developed fuse tube—provides the higher interrupting capacity needed on some of your distribution feeders . . . without sacrificing linemen's safety . . . without double-venting . . . without resorting to an oversize bore . . . and without a cost premium.

This high interrupting capacity is achieved through two new developments which result in (a) minimizing the energy developed within the fuse tube and (b) absorbing this reduced energy in a unique recoil mechanism. Low fault interruption has not been sacrificed either. It is assured by a strong, fast-acting flipper.

Specialists in High-Voltage Circuit Interruption since 1910

Handles lightest faults, too!

Re-usable extension rod shortens arc length, reduces gas generation
S&C Positrol Fuse Link permits precise system co-ordination
Strong, canvas-base bakelite backs up fiber liner
30

RATINGS

	Amperes	
KV	Continuous	Interrupting (RMS, Asymmetrical)
7.5	100	12000
15	100	10000

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

NEWS-SCOPE

FUTURE NEWS ▶

Expansion of Britain's atomic power program is in the works as a result of the critical oil shortage caused by Suez closedown. The government is taking a new look. Watch for Britain's Minister of Fuel and Power to announce the size and scope of the accelerated program within a week or two.

Look for a shakeup in Indiana's public service commission. It follows on heels of the inauguration of a new governor there.

Eisenhower Administration is dead set on getting John Day project underway this year whether it is on an all-federal or a partnership basis. The project is already authorized as a federal project. The Administration will ask for construction funds to get the project started. It still likes the partnership approach, but it wouldn't block a federal project if Congress leans strongly in that direction.

Defense Department will unveil its solar energy experimental program at a meeting in Phoenix, Ariz. Jan. 21. Assistant Secretary Furnas, who heads up military research and development, will reveal some details of the extensive work.

LATE NEWS ▶

Hot prospect for Republican vacancy on Joint Congressional Atomic Energy Committee is Rep Jack Westland of Washington, a champion golfer who is expressing intense interest in the committee spot . . . Sen Chapman Revercomb (R-W. Va.) is slated to become a member of the Senate Public Works Committee which oversees Army Corps of Engineers and TVA projects . . . Revercomb would replace Sen Thomas H. Kuckel if and when the California Republican moves to Senate Finance Committee.

National Association of Electric Companies has reduced dues by 12½%, bringing total reductions over a two-year period to 27½%.

Federal Power Commission last week: issued preliminary permits to Appalachian Electric Power Co for a proposed 60,000-kw hydro project on the Roanoke River in Virginia and to Alabama Power Co for a new generating plant at Lock 13 on the Black Warrior River in Alabama; named former assistant general counsel John C. Mason to the newly created post of Deputy General Counsel, of the commission.

Bureau of Reclamation has approved wholesale power rates for Falcon Dam on the Rio Grande near Brownsville, Tex. Schedule provides for peaking capacity charge of $15 per kw per year of billing demand and monthly charge of 1.75 mills for first 400 hours and one mill thereafter. No contracts have been executed yet for sale of power.

Washington State Supreme Court has set Jan. 18 for a hearing on a case testing constitutionality of the state power act. The appeal seeks to enjoin Clallam County PUD from joining other PUD's in generation and marketing of power, as authorized by the act. County superior court had ruled in favor of the PUD.

Halsey Stuart wins $12 million Pacific P&L Co first mtge 5⅛% bonds (Baa) due 1987 with a bid of 101.22; reoffers at 102.643 to yield 5.20% . . . **Kidder, Peabody, Eastman Dillon group wins** 90,000 shares Pacific P&L $100 par 6.16% preferred stock at 100.0599 per share; reoffers at 102.625 to yield 6%. For earlier financing see p 93.

PEAK LOADS ▶ **Winter peaks in 1956 edged up 4.45%** above the previous year—somewhat less than had been anticipated. Mild weather across the country was unanimously blamed. But local slowdowns in industrial activity and delayed installation of home Christmas lighting were also cited. Of the 86 electric utilities contributing to Electrical World's survey, less than half said they had set new winter peaks during the week before Christmas. A few reported 1956 December peaks actually lower than those for 1955. Several utilities looked for winter peaks in January, encouraged by load gains and temperature drops after the holidays (p 44).

EVENTS ▶ **The Soviet Union is "catching up" with U. S. science in some areas,** running a fast race in others. Emergence of "inspired" scientific leaders in Russia is threat to U. S. leadership says Russian Expert John Turkevich in exclusive interview (p 47).

Tennessee Valley Authority output in fiscal 1956 hit 57.5 billion kwhr—a 38% boost over the previous year, annual report shows (p 45) . . . Combination of nuclear power and pumped storage hydro plants will make possible fuller utilization of California water resources according to a state engineer (p 51).

Seventy-fifth anniversary jubilee of cable progress is marked with concisely chronicled history of electric cable by Dave Williams of Con Ed. Voltage on cable has increased from 120 to 330,000 v on overhead lines and from 120 to 230,000 v on underground lines in the U. S. during the 75-year period. You'll find a full list of cable's historic highlights in the article and some interesting statistics on cable use by Con Ed (p 52).

WASHINGTON ▶ **Historic hearings begin in Washington** on safety aspects of Power Reactor Development Corp's proposed fast breeder nuclear reactor (p 46).

ATOMIC PROGRESS ▶ **U. S. prestige is high in field of atomic power development,** world opinion survey shows. Sampling of opinion in 11 foreign countries shows 52% of respondents rank U. S. first in civilian nuclear power development; 40% rank Britain first; only 8% rank Russia first (p 49).

GENERATION ▶ **A jack and leverage device** made partly from scrap metal is simplifying and speeding replacement of manheads in old boilers at Mill Street Plant of Indianapolis P&L. Picture and specifications are included (p 72).

TRANSMISSION ▶ **Maybe its short of a revolution, but pace-setting innovations are cropping** up in design of transmission structures. Northern States Power, casting around for more aesthetic designs, inspired senior students at University of Minnesota's School of Architecture to develop some highly unconventional structures (cover p 62).

Florida Power Corp is trying prestressed concrete H-frames for a 110-kv transmission line—first of its kind in the U. S. Article details installation experience and gives background of tests and expected performance of these structures. Costs run about 60% greater than line built with Southern pine frames, but longer life and lower maintenance costs are anticipated. Steel content is much lower than in conventional reinforced concrete (p 64).

Georgia Power will use tubular steel H-frame construction for selected locations such as river crossings. Costs run about 12½% above wood structures, engineers calculated. This H-frame has a beam-type crossarm attached by flexible shackles to two tubular-steel poles resting on pre-cast concrete bases. Stability depends on the guys (p 56).

SUMMARY OF THIS WEEK'S ELECTRICAL WORLD

DISTRIBUTION ▶ **Sag data useful as a guide for design** of short-span lines with ruling spans of 150-ft and below is compiled on Engineering Reference Sheet (p 74).

SUBSTATIONS ▶ **Lever for raising and lowering main cylinders** of oil circuit-breaker mechanisms has been developed by Ohio Power's Philo electrical maintenance dept. It saves up to 80% in time and labor for removal and replacement of this heavy part over the former method involving use of threaded rods (p 72) . . . New manual contains guide for welding aluminum bus (p 60).

STREET LIGHTING ▶ **Up-to-date street lighting pays off in terms of better municipal relations,** writes Tampa Electric's Illuminating Engineer J .A. Banton in article on Tampa's street lighting modernization program. The utility installs, finances, operates, and maintains the lights and sells service to the city. With this kind of service, the company finds city officials are more cooperative in matters such as zoning changes, placement of poles, and substations (p 54).

Specially designed trailer for transporting street lighting glassware, arms, and equipment helps Portland General Electric speed delivery and reduce breakage. Crew and shop personnel rigged the trailer on an old automobile chassis, retained the hand brake system so that vehicle can be parked and unhitched from towing truck (p 67).

SELLING ▶ **Big appliance gainers for 1957** will be electric dishwashers with sales 18.7% ahead of 1956, food waste disposers with sales 10.2% above 1956, and built-in ranges with sales 10.4% above 1956. These are NEMA's forecasts made in year-end review and forecast of appliance sales. In 1956 some of the old stand-bys—refrigerators, standard ranges, and home freezers—took sales dips below the previous year (p 76).

You'd never believe that a modern industrial lighting system could have such a dramatic effect on output, morale, and safety until you've read the story of Greist Mfg Co's experience (p 80).

MANAGEMENT ▶ **Electric utility security offerings go into high gear and furnish new test** of "tight money" situation. Initial results look favorable (p 92) . . . Niagara Mohawk request $7 million annual rate boost for 25-cycle industrial customers (p 93) . . . Study suggests why engineers join union (p 94).

PEOPLE ▶ **C. Evans Parks is new vice president at Iowa Southern Utilities,** moving up from assistant-to-the-president. Duquesne Light promotes John E. Gray to general superintendent of construction, E. M. Gue to system planning engineer (p 100).

MANUFACTURERS ▶ **Electrical manufacturers will ship $21.5 billion worth of products in 1957,** NEMA predicts. That compares with $19.6 billion last year. Sales increases will range from 5% to 15% above 1956 for various branches of industry (p 98) . . . Capacitor kilovars in U. S. increased 6 million in 1956 to bring total to 40.5 million, manufacturer reports (p 98).

NEW EQUIPMENT ▶ **New line of heavy-duty, open dropout cutouts** feature fuse tube made of fiber-glass-reinforced polyester resin which is said to permit thinner sheath and thicker lining of arc-expelling fiber. Other features are bird-proof construction, compression clamped fittings, silver-plated contacts, high-pressure latch . . . Five-kv magnetic circuit breaker with 2-cycle interrupting time has been developed for use with 4.16-kv distribution systems (p 82).

ENGINEERING TRENDS

Capacitors totalling 15,117,000 kvar would have to be installed by U. S. utilities to bring system pf to 95% on peak, based upon 1956 load records. Cost of these capacitors is estimated at $75 million by one large manufacturer.

Clearances inside a steam turbine can be measured continuously with an electronic instrument recently developed by Bureau of Standards. Detecting element is a mutual-inductance micrometer probe on a ceramic base which withstands steam temperature and erosion in the blade section of the turbine. Leads bring ac voltage induced in the probe to an external detector and amplifier for reading on a meter calibrated to show probe-to-surface distance.

Aluminum wire is joined to copper wire successfully by compressing a lug of matching metal on the end of each and joining the lugs with a bolt and nut. Two lock washers or a Belleville washer maintain contact pressure between lug surfaces which have been cleaned of oxide and coated with inhibitor.

Turbine in a boiling-water-reactor plant will be highly radioactive during operation because of the short-lived products of neutron capture by oxygen in the water. But this activity will vanish for all practical purposes shortly after shutdown.

Electron-beam synthesis of hydrocarbons will produce rubber-like insulating material for high-voltage cable.

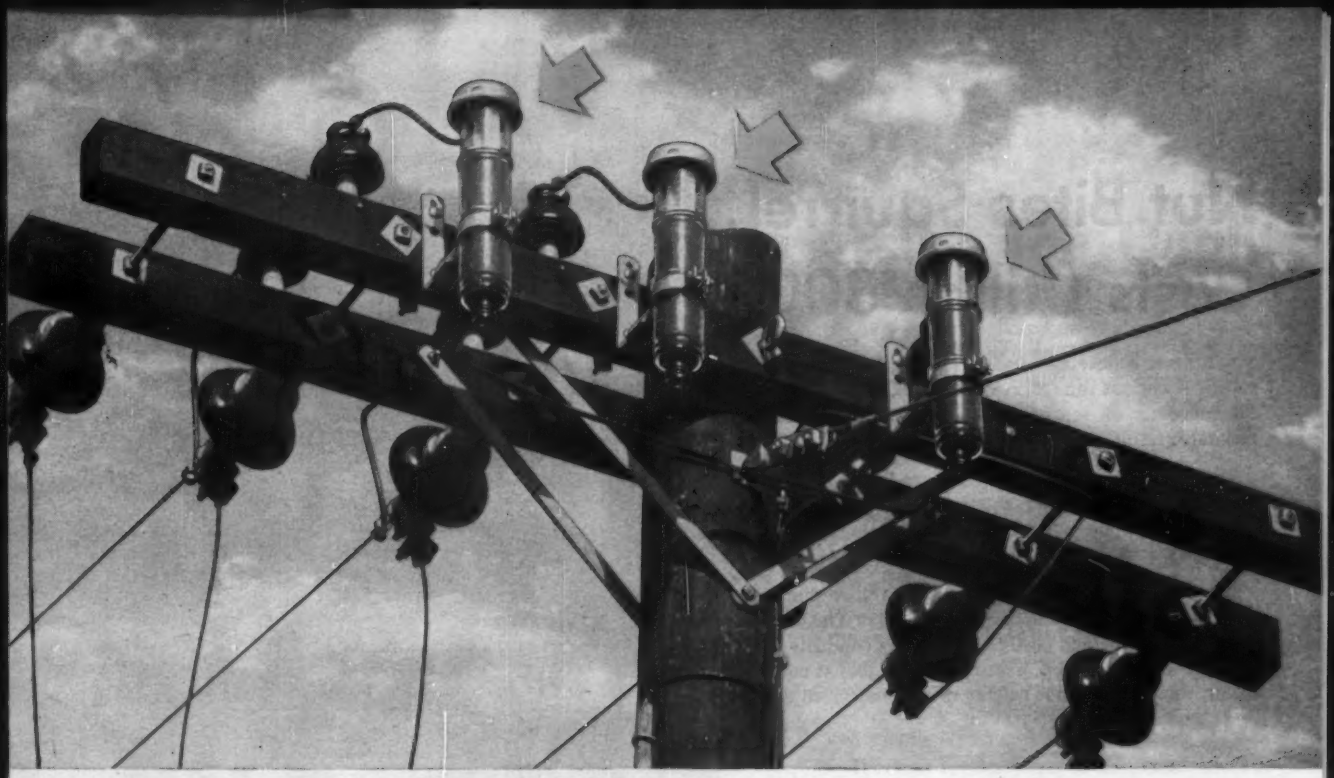
Corrosive attack of a contaminated atmosphere on insulator hardware is sometimes accelerated by electrostatic overstresses.

FROM EDITORS IN THE FIELD

To reduce delays in line construction, Southern California Edison Co uses a two-man crew and truck equipped with hydraulic lift to deliver transformers, crossarms, etc, from the warehouse to job sites. This practice saves loading extra material on the line truck and eliminates return trips by the line truck. It does require close dispatching of material from the warehouse to the job and close planning of each job by the line foreman.

Use of a portable voice-recording machine makes the inventory of warehouse material a one-man job for Idaho Power Co. Formerly one man counted material while another tallied the record. The second man was able to produce a clean, neat, and legible record as he did not handle the material. Now, one man counts material and records the inventory on the machine and a clean, legible record is transcribed in the office. The second man is freed for other work.

Insulated caps for the tops of bushings of 7.2-kv grounded transformers eliminate interruptions caused by animals, such as squirrels, climbing on them. Central Maine Power Co uses a cap that covers the bushing connection and a small part of the primary tap.



L-M valve arresters are not limited in application by the available short-circuit current; pass only small values of follow current regardless of system capacity. Heavy-duty spark gap transmits severe discharges without burning or pitting, and allows the arrester to go into action fast.

Eleven-year operating records show...

99.96% Performance Record For L-M Valve Arresters On Utility System

Eleven-year operating records of a large midwestern utility show that L-M valve-type lightning arresters have an outstanding performance record. During this time, L-M valve arresters have accumulated 138,110 service years on this system, and only 51 of these arresters have failed during this span as evidenced by proper functioning of the isolator. Of the 1,873 L-M arresters removed from service because of system changes, all were passed by the utility's electrical test and inspection department and returned to stock.

Positive Protection

L-M valve arresters provide optimum balance between 60-cycle sparkover and impulse sparkover. Heavy-duty spark gap transmits severe discharges without burning or pitting, and allows the arrester to go into action fast. L-M's exclusive valve element assures maximum surge discharge capacity and minimum I.R. drop.

The L-M patented Isolator provides positive protection against feeder lockout in the event of an arrester failure. If the arrester should ever become damaged, the Isolator instantly disconnects the ground lead.

Get Complete Information

Ask your L-M Field Engineer for Bulletin LA-2 on L-M's Type E arrester, which gives specific information on arrester design and performance. Or write Line Material Company, Milwaukee 1, Wis. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ont.

Here are the records for the years 1945 through 1955

Year	Arresters In Service	Isolator Operations In Service	Arresters Tested	Arresters Failed In Test
1945	3,286	5	0	0
1946	4,322	2	11	0
1947	6,020	2	137	0
1948	7,469	4	118	0
1949	8,686	3	186	0
1950	11,392	7	161	0
1951	13,950	3	270	0
1952	15,282	7	204	0
1953	20,498	13	158	0
1954	21,105	2	383	0
1955	26,100	3	245	0
Total Arrester Service Years	138,110	51	1,873	0

51 ÷ 138,110 x 100 = .036% Failure Rate

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LINE MATERIAL Lightning Arresters

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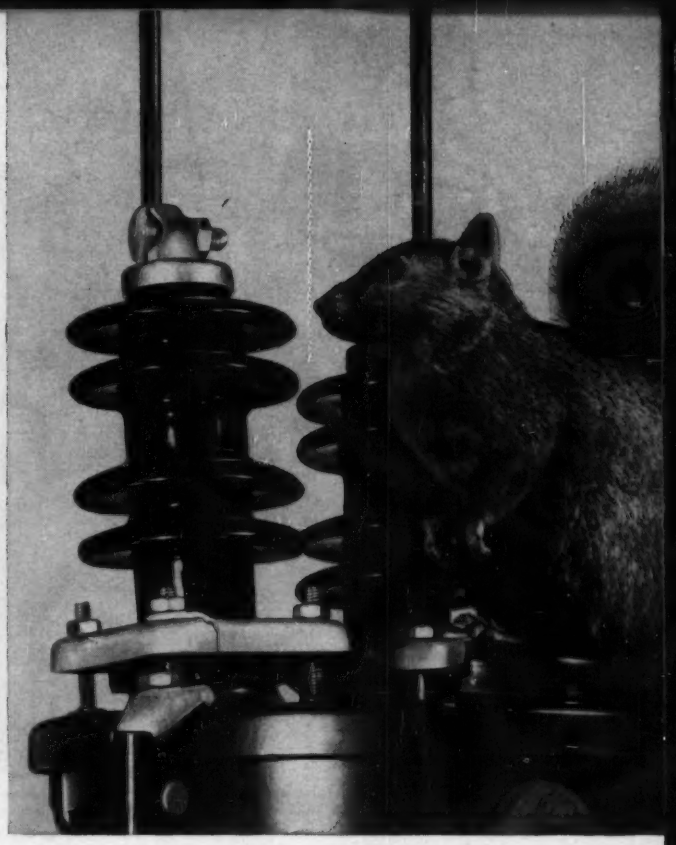
Nut Bites Squirrel... Costs Utility $3000



You'll never believe it—we didn't either, but it actually happened! A curious squirrel evidently took a bite of the nut on the connector on top of a 7620-volt transformer—with the inevitable result. The nut bit back!

The squirrel's flaming body dropped into the dry grass below, which caught fire and in turn set the pole ablaze. Eventually the pole burned through, dropping primary wires onto the secondaries below.

Result: the pole had to be replaced—and so did some 30 television picture tubes in customers' homes. The whole deal was embarrassing and costly to the utility company—and to the squirrel's family also, which probably still has never satisfactorily explained to the neighbors what happened to Pappy.

It Can't Happen Here... on L-M's New Bite-Proof Transformer Bushing

This new bushing is designed to take the tap vertically, conforming to EEI-NEMA standards. Not only does it have a hand-tightening knob (which can't be spun off—but can be intentionally removed) but also it has a phenolic cap which covers the terminals completely. No hot nuts or other live parts are accessible.

If you use bare wire jumpers, we suggest a neoprene sleeve, as shown. The phenolic cap is constructed so as to provide adequate drainage.

On protected transformers a 3/16-inch slot is provided for the lightning arrester terminal. Nothing except the most persistent hummingbird sitting on the arrester could reach the hot terminal—and that's pretty unlikely.

This new bushing is representative of the many plus features found only in L-M Round-Wound Transformers®—and another reason why you should order more L-M Round-Wounds. Ask the L-M Field Engineer to tell you other reasons for buying these outstanding and highly efficient transformers. Or write Line Material Co., Transformer Div., Zanesville, Ohio.

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LM® LINE MATERIAL Transformers

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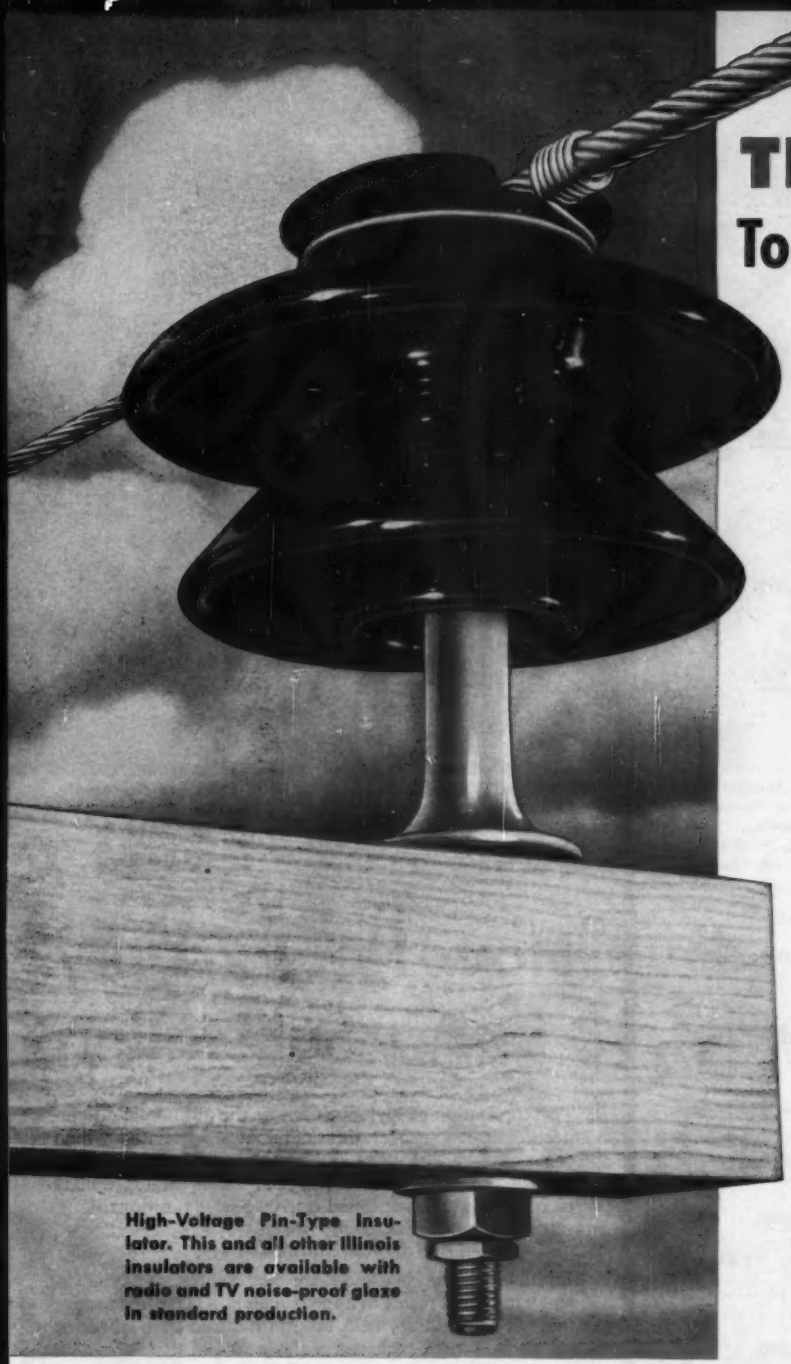


High-Voltage Pin-Type Insulator. This and all other Illinois insulators are available with radio and TV noise-proof glaze in standard production.

TRIPLE-TESTED
To Assure Top Quality

At Illinois Electric Porcelain Co. the manufacture of electric porcelain is no longer an art or simply a skilled craft. New standards of material testing, manufacturing controls, and rigid final tests have made porcelain manufacturing a scientific production procedure.

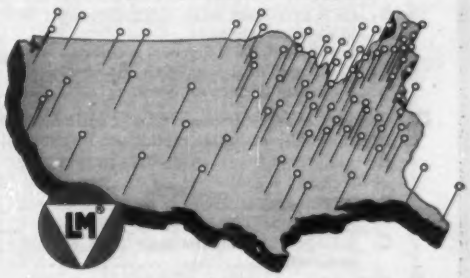
By triple-testing as set up by Illinois, we mean: (1) incoming materials are tested in a new, complete ceramics laboratory; (2) quality control during manufacturing assures uniformity and compliance with high standards in molding, pressing, drying, glazing, and firing processes; (3) rigid mechanical and electrical tests to destruction are made on a representative quantity of the finished product. The result is a product the user of Illinois porcelain can depend on for uniformity, consistently high strength and insulating value.

The high-voltage pin-type insulator shown is available in EEI-NEMA ratings 56-1, 2, 3, 4 for 23, 34.5, 46 and 55 kv with radio noise-proof glaze as standard.

Illinois Electric Porcelain products include pin and suspension insulators, strain insulators, switch and bus insulators, hardware and fittings.

For fast service, just pick up the phone now and call your nearest L-M office. Or ask your L-M Field Engineer for complete information and a copy of Bulletin DL8; or write Line Material Company, Milwaukee 1, Wisconsin.

67 L-M Warehouses... there's one near you!



ILLINOIS ELECTRIC PORCELAIN COMPANY
(a McGraw Electric Company Subsidiary) Macomb, Illinois

Distributed by **LINE MATERIAL** *Electrical Porcelain Insulators*
A McGRAW ELECTRIC COMPANY DIVISION

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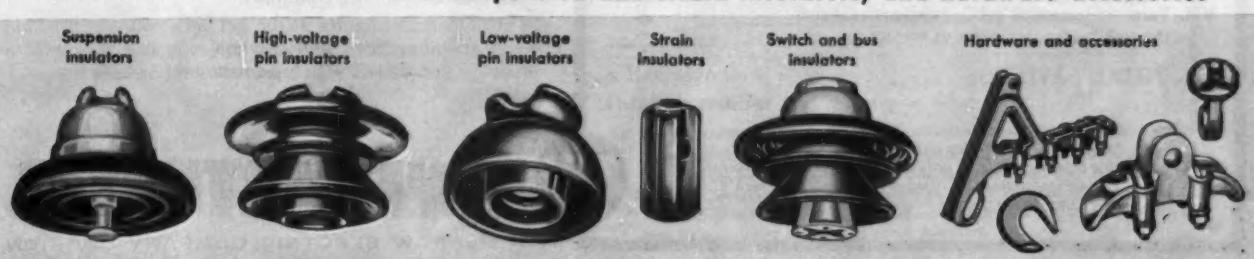
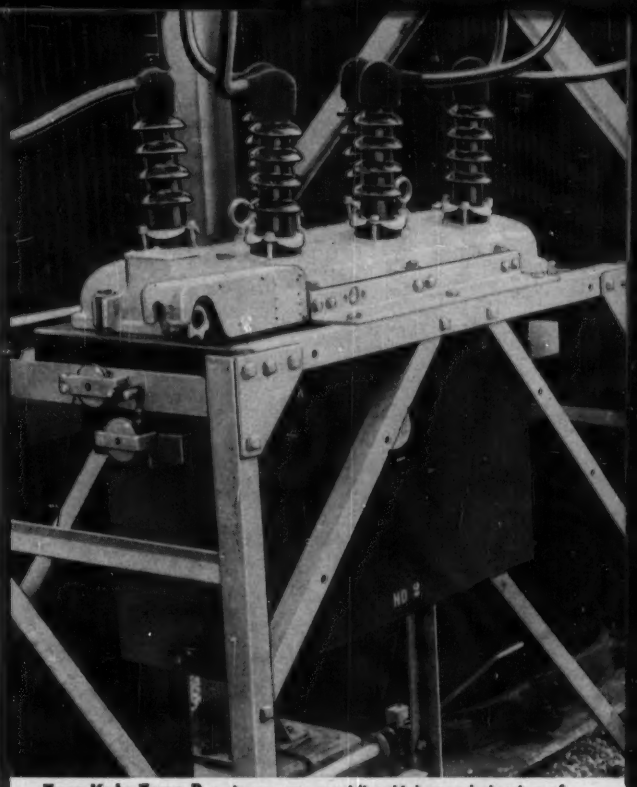
L-M offers an extensive line of suspension and strain insulators, and hardware accessories



Analysis of Savings Using Kyle Reclosers for Five Years*

	Savings on 100 Substations	
I. Initial Investment Costs		
A. At substation. A Type R OCR as compared with an equivalent OCB with AC tripping and reclosing.		
1. Initial savings in equipment costs favoring each OCR—$3227.00. Total savings for 100 substations for 5 years— 2 x 5 x 100 x $3227/20.....	$161,350.	
2. Initial savings in labor costs to install transformers and wiring necessary to operate OCB—$30 per OCR. Total savings for 100 substations for 5 years— 2 x 5 x 100 x $30/20.....	1,500.	
Total initial investment savings with OCR's		$162,850.
B. On distribution feeders with 5 sectionalizing points per feeder.		
1. Equipment costs of 3 OCR's and 2 sectionalizers exceeding that of 5 fused cutouts = $491. Additional costs to utilize self-protective scheme for 200 feeders for 5 years = 5 x 200 x $491/20.....(—)	$ 24,550.	
2. Labor costs of installations. OCR exceeding that of fused cutout = $15. Additional cost to utilize self-protective scheme for 200 feeders for 5 years = 5 x 200 x $15/20.....(—)	750.	
Total additional costs of OCR's and sectionalizers over fused cutouts.....		— 25,300.
C. Net savings in initial costs with OCR's....		$137,550.
II. Operating Costs (estimated 9 outages per feeder through transient conditions annually)		
A. Savings in frequency and duration of service trips resulting from transient faults		
40 man-hours @ $5/hr. per feeder.	$200.	
25 truck hours @ $1/hr. per feeder	25.	
Cost of fuse links per feeder.....	5.	
Total cost of transient outages per feeder.....	$230.	
Total 5-year cost for 100 substations = 5 x 2 x 100 x $230.....	$230,000.	
B. Increased revenue resulting from reduced outages. 1500 KWH per outages per feeder for 5 years through loss of service @ 2¢ per KWH = 1500 x 2 x 100 x 5 x $.02.....	30,000.	
C. Total savings from transient fault protection for 5-year period.....		$260,000.
III. Maintenance Costs		
A. OCR and sectionalizer maintenance cost @ $25 per unit annually = $25 x 5 x 2 x 100 x 5.....(—)	$125,000.	
B. OCB additional relay calibration costs @ $25 per unit annually = $25 x 2 x 100 x 5.....	25,000.	
C. Total additional costs of OCR and sectionalizer maintenance for 5 years.....		— $100,000.
IV. Carrying charges (conservatively estimated as 10% annually of initial capitalized investment)		
A. At substation. Savings represented by OCR's = ($3227 + $30) x 2 x 100 x 5 x .10.....	$325,700.	
B. On line, additional cost of automatic scheme = ($15 + $491) x 2 x 100 x 5 x .10....(—)	50,600.	
C. Savings in carrying charges with OCR's and sectionalizers.....		$275,100.
V. Subtotal.....		$572,650.
Additional savings resulting from Transient Fault protection		
VI. Savings realized by elimination of conductor and equipment damage through extra-fast clearing on heavy faults.....		$?
VII. Value of improved public relations realized through better continuity of service.....		$?
VIII. TOTAL SAVINGS.....		**Well over half a million dollars!**

**Costs are conservative estimates based on the best available information from utilities. System used to illustrate average installation consisted of 100 substations each with two 15 kv feeders, and amortized in 20 years.*



Two Kyle Type R reclosers are providing high-speed clearing of 13.8 kv feeders for transient fault protection and automatic disconnecting of permanent faults with minimum substation investment.

How Heavy-Duty Substation

The application of Kyle reclosers as the automatic disconnecting device in substations eliminates the relatively high costs of circuit breakers and associated substation equipments. This alone offers savings of a half million dollars or more in five years, based on 200 feeder positions.

Lower Initial Costs

Initial investment in Type R recloser equipment of equivalent rating will result in approximately $3,000 savings per feeder. In addition, field reports indicate that labor for installing Type R reclosers is about 50% of that for circuit breakers. The maintenance cost for reclosers is also lower than for circuit breakers.

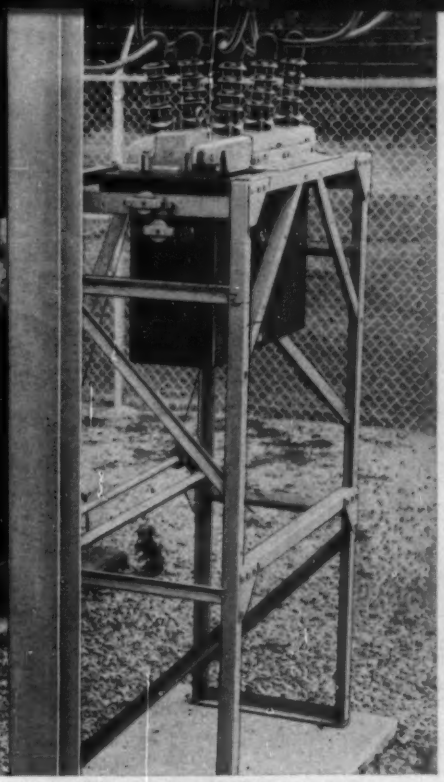
Fewer Outages

L-M Kyle reclosers can also be justified as a fault-protective device that will reduce the number of outages caused by transient or non-persistent causes. Kyle reclosers have extremely fast opening characteristics, clearing circuit in less than 2 cycles, which minimizes conductor burndown and increases service continuity.

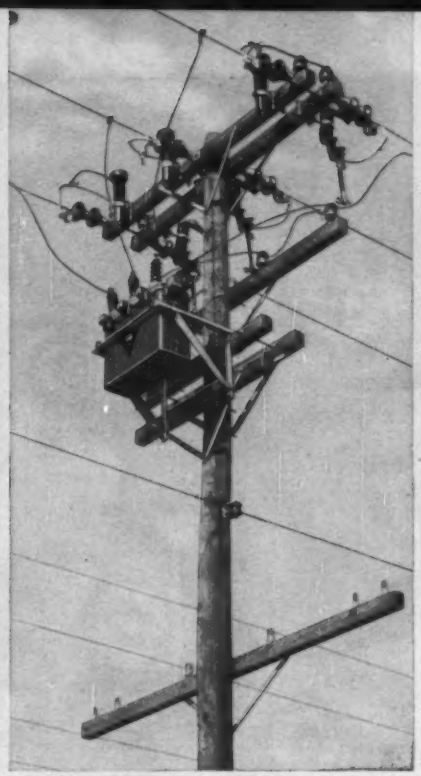
Compare the figures at the left with your construction and operating costs and see how you can save over a half million dollars with Kyle reclosers.

LINE MATERIAL

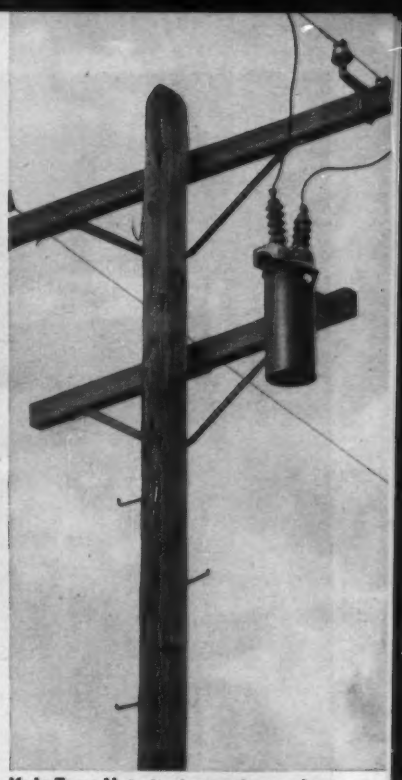
A McGRAW ELECTRIC COMPANY DIVISION



It is possible to clear over 90 percent of total circuit faults and reduce permanent faults with high-speed Kyle reclosers.



Kyle Type 3H 3-phase reclosers provide coordinated protection on rural lines with up to 1250 amperes at 14.4 kv. Where faults persist, recloser locks open on all 3 phases and confines trouble to a small area.



Kyle Type H single-phase recloser reduces the number of outages on rural lines caused by conductors whipping together on long spans, small branches grounding a conductor, or a lightning discharge.

Kyle Reclosers Reduce Investment And System Operating Costs

L-M high-speed reclosers provide better service continuity and lower operating costs by reducing conductor burn-down caused by transient or non-persistent faults on the system. It is possible to clear over 90 percent of total circuit faults and reduce permanent faults with high-speed Kyle reclosers. Such faults are often caused by lightning, arrester flashover, tree limbs shorting the conductors, or conductors whipping together on long spans.

Eliminate the Shaded Area

The shaded area in the chart at right represents the additional fault-clearing ability of L-M high-speed Kyle reclosers. Kyle reclosers clear transient or non-persistent faults on the circuit with no significant damage to the system or interruption of service.

All Kyle reclosers can be coordinated in series to provide complete transient protection over entire distribution system.

Get Complete Information

Ask the L-M Field Engineer for more information on how Kyle reclosers can be profitably applied to your system. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

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Kyle® Reclosers

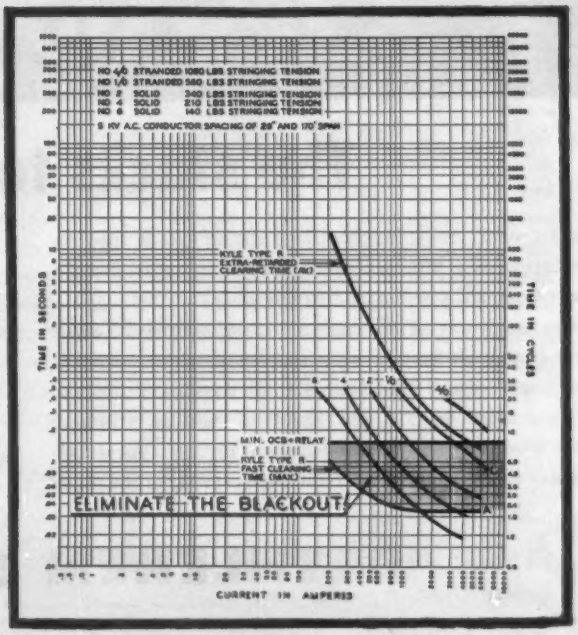
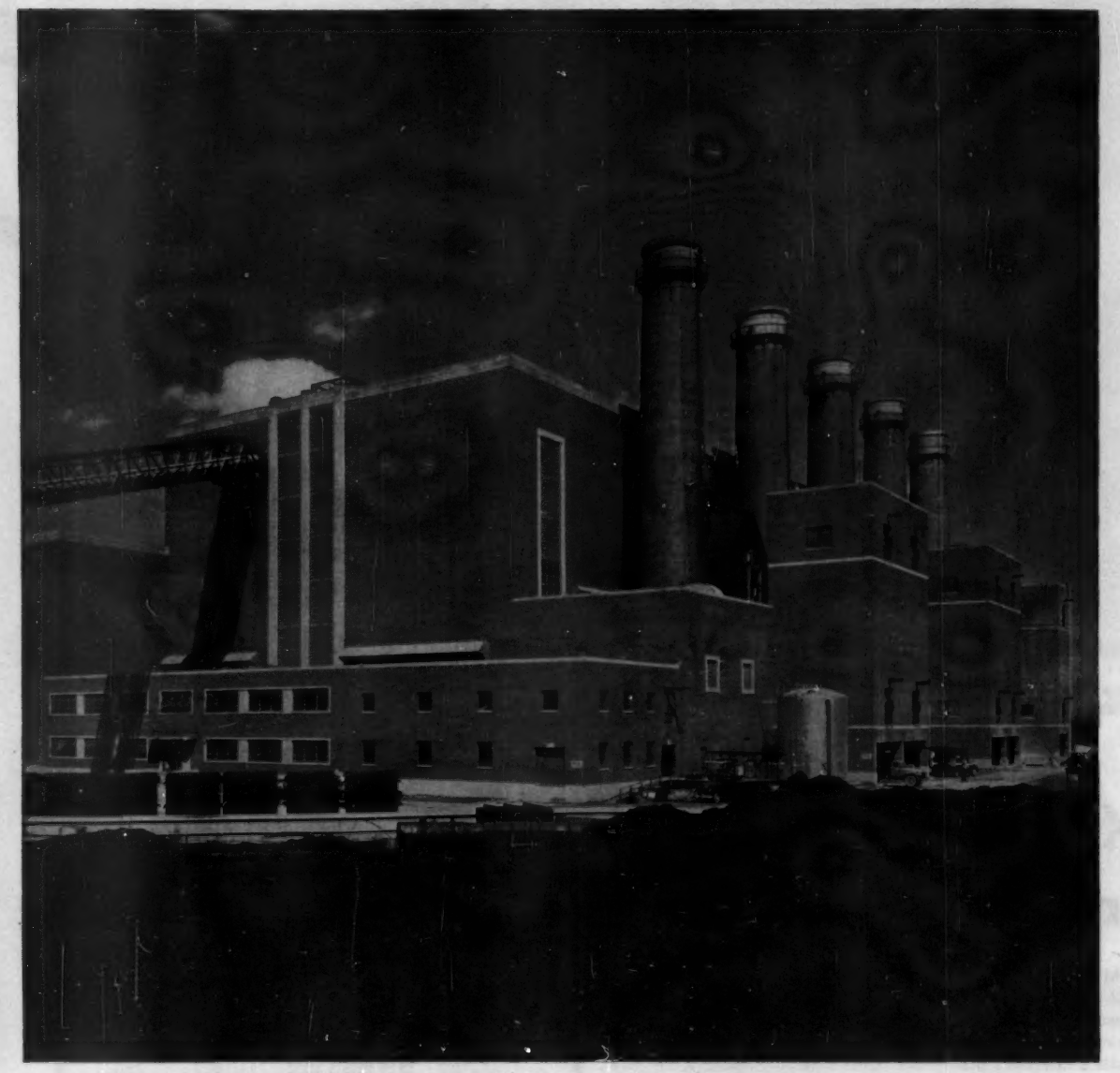

NO 4/0 STRANDED 1080 LBS STRINGING TENSION
NO 1/0 STRANDED 540 LBS STRINGING TENSION
NO 2 SOLID 340 LBS STRINGING TENSION
NO 4 SOLID 210 LBS STRINGING TENSION
NO 6 SOLID 140 LBS STRINGING TENSION
5 KV A.C. CONDUCTOR SPACING OF 28" AND 170° SPAN
KYLE TYPE R EXTRA-DELAYED CLEARING TIME (MAX)
MIN. OCB+RELAY
KYLE TYPE R FAST CLEARING TIME (MAX)
ELIMINATE THE BLACKOUT
TIME IN SECONDS
TIME IN CYCLES
CURRENT IN AMPERES

Chart shows primary line burndown characteristics for weatherproof wire. It also gives the maximum clearing time for high-speed Kyle reclosers and minimum clearing time for the average circuit breaker plus relay time. The shaded area represents the additional protection that can be obtained with Kyle reclosers in place of circuit breakers.



The stacks tell the story

The far stack, newly completed, is the tip-off. It foretells installation of a fifth generating unit at Potomac Electric Power Company's newest and largest plant.

This steam-electric generating station, on the Potomac River just across from Washington, has grown enormously since completion of Unit One in 1949. Another 80,000-kw unit was added in 1950, and 90,000-kw units in 1954 and 1956. When Potomac Electric puts Unit Five into operation, probably in the spring of 1957, the rated capacity of the plant will total 430,000 kw; its effective capability, 493,000 kw.

The steelwork required to support and house these five huge units was fabricated and erected by Bethlehem. In total, 8,400 tons of structural steel and over 300 tons of substation structures were supplied to help fill the growing demand for electric power in and around the nation's capital.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

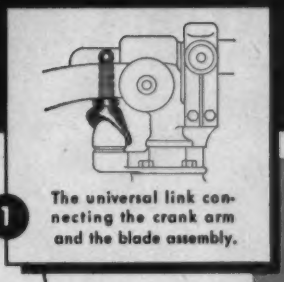
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

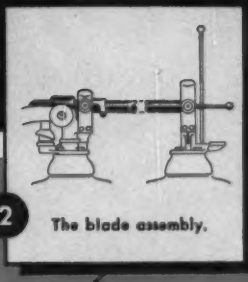
BETHLEHEM STEEL

ONLY 3 MOVING ELEMENTS

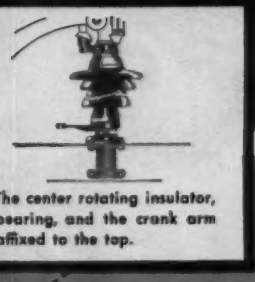
Operate the type WAG high pressure switch



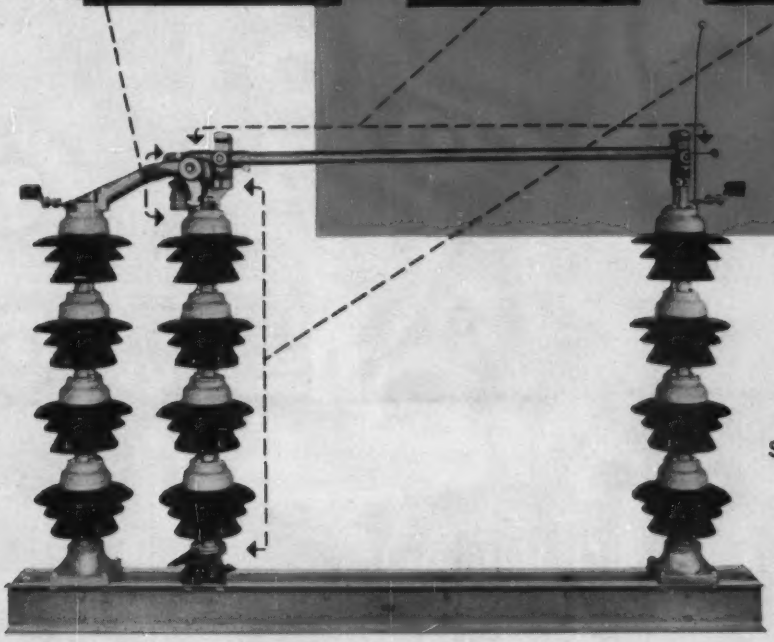
1 The universal link connecting the crank arm and the blade assembly.



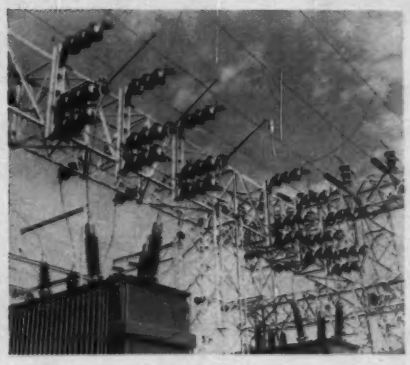
2 The blade assembly.



3 The center rotating insulator, bearing, and the crank arm affixed to the top.



AMPLITACT CONTACTS ARE AVAILABLE TO MEET UNUSUALLY HIGH SHORT CIRCUIT CURRENTS.

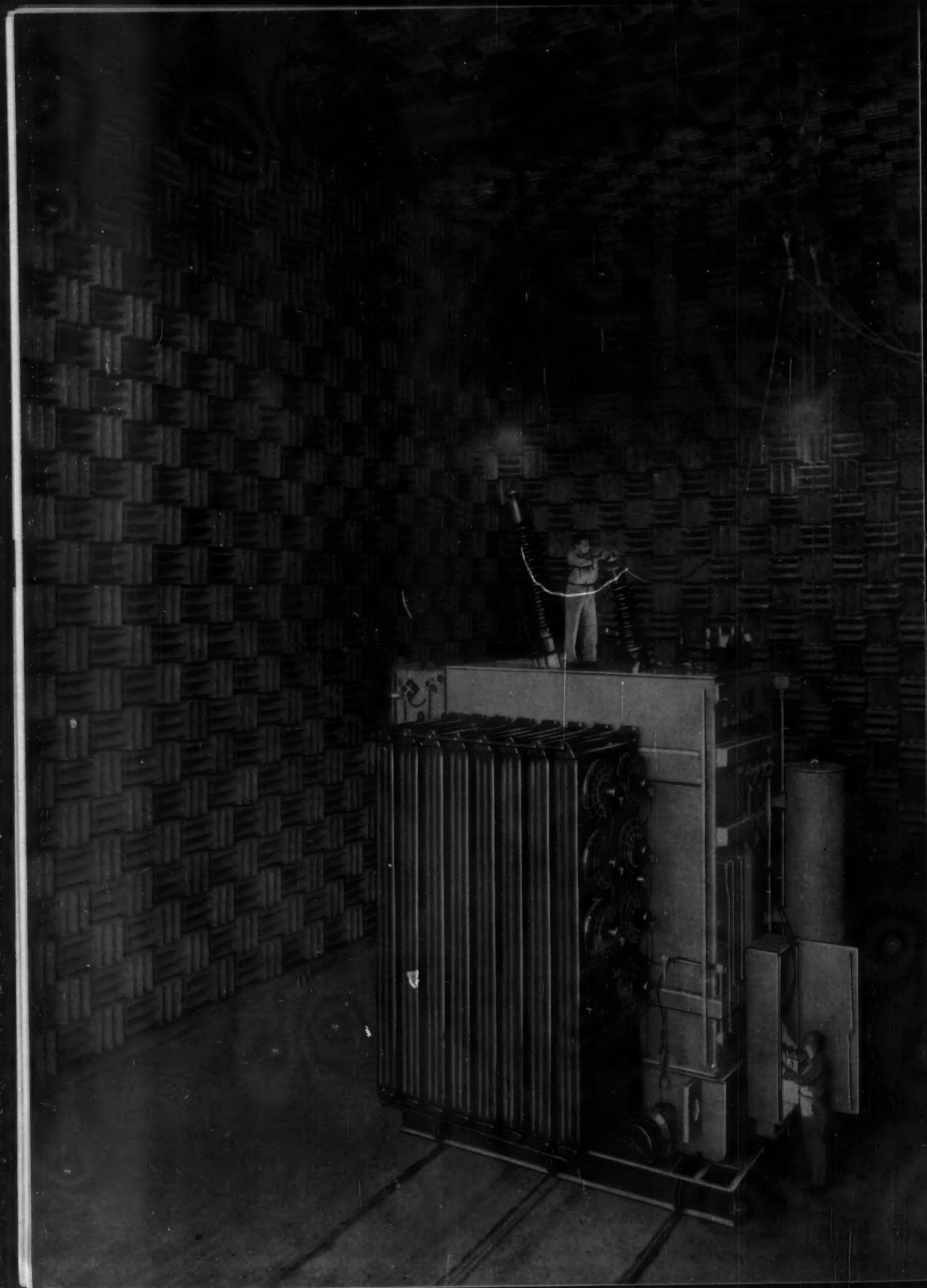


An extremely simple operating mechanism gives the Type WAG High Pressure Air Break Switch a superior mechanical advantage, which assures complete dependability under all climatic, operating, and atmospheric conditions—a fact proved by years of continuous service on applications in every section of the nation. The three moving elements are factory set to preclude any possibility of maladjustment.

Ease of operation, positive blade control, high contact pressure and wide contact deflection, plus a host of other outstanding features add up to unsurpassed performance and economy. Get all the facts in Bulletin 390-R, which we'll gladly send on request. Then you, too, will specify Southern States Type WAG Switches.

SOUTHERN STATES EQUIPMENT CORP.

HAMPTON, GEORGIA



Helping the industry meet its growing loads

NEW TEST CENTER . . . Giant stride in design of EHV transformers*

In the next ten years, more power producing and transmission capacity will be installed than now serves the entire nation. This expansion obviously will accelerate the trend to higher voltages and higher capacity equipment.

On November 8, 1956, Westinghouse put to work the largest and most completely equipped facility ever built, solely dedicated to power transformer design. It is the new research and commercial testing laboratory at Sharon, Pa. This ultramodern facility adds new vitality to Westinghouse leadership in helping the electric utility industry.

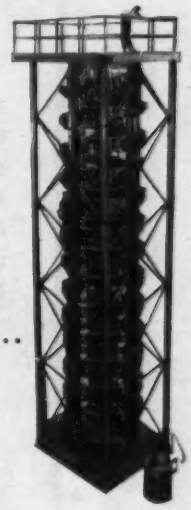
What are the problems that will be solved? More capacity in single units is one. Further reduction of vibration and noise in transformers is another. This laboratory will enable our engineers to verify and place in production transformers with tested, wholly new insulation systems—transformers constructed of materials with new endurance limits.

The results of this intensive investigation? Revolutionary new bench marks of transformer performance. Transformers that are quieter, more capable than ever before. Transformers that are more efficient and reliable. Transformers that are lighter, more compact per cubic inch of capacity. Transformers that are capable of doing the prodigious tasks equipment of the future is expected to do.

This new transformer laboratory is one more assurance that products Westinghouse brings to market will help electric utilities provide low-cost power, serve customers better, meet growing loads.

J-97198

*Extra High Voltage.



5,200,000-VOLT SKYSCRAPER . . .

This specially designed surge voltage generator is an important and unique tool in the verification and testing of new insulation systems at Westinghouse. This unit is comprised of one hundred and four 100-kv capacitors arranged in layers to a height of 52 feet.

EHV AND CORONA-FREE . . .

Analyzing and developing new and better insulation structures for higher voltage transformers is the primary task of this new radio influence testing room. In testing completed designs, as above, engineers measure R. I. voltages picked up by the loop antenna. Transformers being verified are energized by the 250-kv insulation-testing transformer at the left.

New knowledge pouring from this huge, new Westinghouse transformer research and test center can be measured in voltage added, tons of weight eliminated, greater capacity gained, and in better transformer investments.

WATCH WESTINGHOUSE!

*WHERE **BIG THINGS** ARE HAPPENING IN **RESEARCH**!*

Transformers of the future have an appointment here . . .

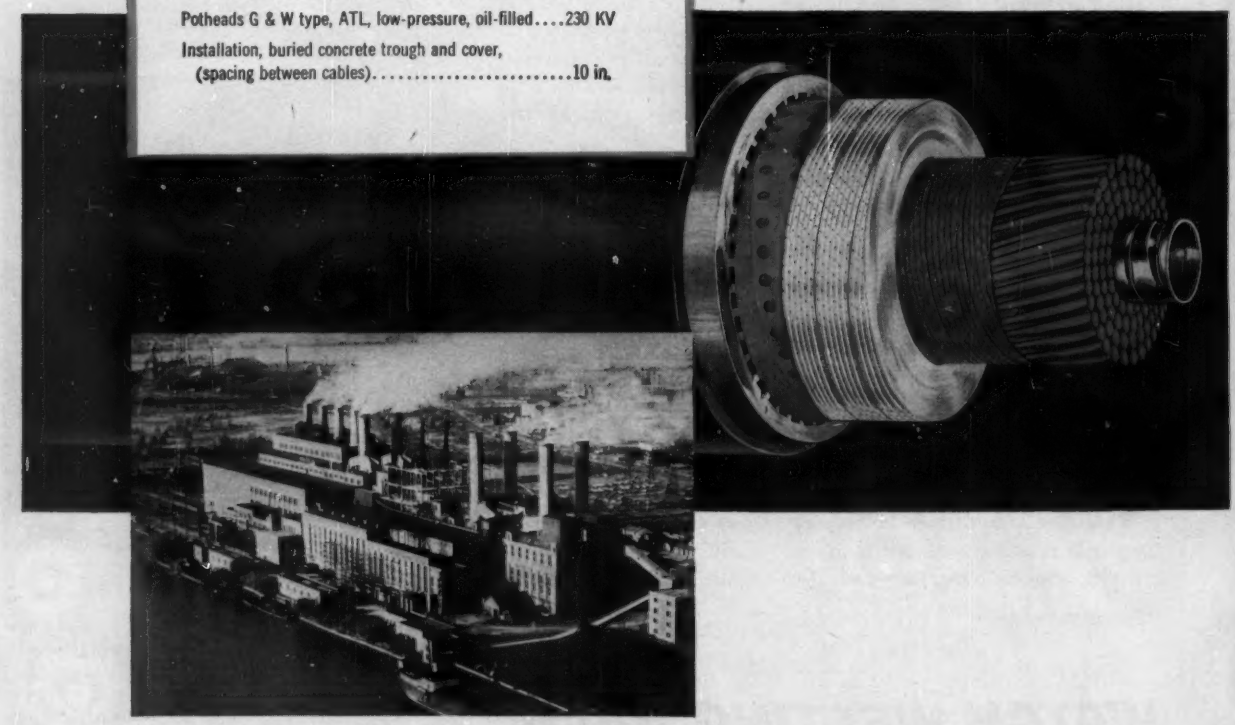
The world's largest and most efficient facility of its kind, this anechoic vault can make complete sound measurements on transformers rated to and above 5,000,000 kva. Here is more proof from Westinghouse that transformers of the future will be smaller and lighter per kva . . . and quieter.

Phelps Dodge

FIRST 230-KV FOR

Circuit Data and Cable Rating

Type	Low-Pressure, Oil-Filled to AEIC 5th Edition
Cable Rating (nominal)	230 KV
Number of Circuits	2
Number of Cables	7
Capacity, each circuit (at 95% daily load cycle)	240,000 KVA
Length, each circuit (approx.)	1,500 feet
Cable construction	
Steel spiral hollow core I.D.	500 mils
Conductor concentric copper	1,250 M.C.M.
Impregnated wood pulp paper (nominal thickness)	835 mils
Habirloy arsenical fluted lead sheath (lead over flutes)	160 mils
Habirlene (polyethylene) jacket	115 mils
Maximum operating oil pressure	16 psi
Type CC oil reservoir each end, each cable	21 gals.
Maximum conductor copper temperature	
Normal	70° C
Emergency	75° C
Potheads G & W type, ATL, low-pressure, oil-filled	230 KV
Installation, buried concrete trough and cover, (spacing between cables)	10 in.



Cable will connect the main step-up power transformers to the 230-KV switchyard at Niagara Mohawk's Huntley Station shown here.

to make

LOW-PRESSURE, OIL-FILLED CABLE COMMERCIAL USE IN THE U.S.A.!

Output Circuit for Largest Unit of Niagara Mohawk Power Corporation Will Have Some New Features

Phelps Dodge Copper Products Corporation has been chosen by Niagara Mohawk Power Corporation to provide the first 230-KV low-pressure, oil-filled cable for commercial use in this country. The first 230-KV compression cable for use in the U. S., installed at Garrison Dam in North Dakota, was also a Phelps Dodge product.

The cables will be used to integrate new generating units into the Niagara Mohawk System by linking up the main step-up power transformers to the 230-KV switchyard at the Charles R. Huntley Station in Buffalo.

Cable specifications call for some of the longest low-pressure, oil-filled cable lengths ever made. Three single conductor cables are planned for each of two circuits, together with one spare cable. All cable lengths will be continuous without splices.

The cable design will include two unusual features: direct burial—a new installation method for this type of cable in the U. S.; and, for the first time anywhere on this class of cable, a protective jacket of corrosion-proof polyethylene will be used over the cable's lead sheath. Actual production of the cable will be preceded by the manufacture of a prototype cable and extensive testing. Present plans call for the cable to be installed during the early months of 1957.

PHELPS DODGE COPPER PRODUCTS CORPORATION

300 PARK AVENUE, NEW YORK 22, N. Y.

Utilities can save up to 75% in soundproofing

with new Westinghouse power transformers

Westinghouse announces drastic reduction in premium costs paid for transformers with lower than standard sound levels. Extensive improvements in manufacture and application of materials have created spectacular new performance available to all users of Westinghouse power transformers. Noise levels can now be reduced for much less cost.

Westinghouse power transformers—already smaller and lighter per kva than transformers of any other design or manufacture—will achieve lower sound levels and promise to show even greater advantage in weight and size comparisons. Here is new performance available for all new purchases of Westinghouse transformers—501 kva up to the world's highest capacity three-phase units.

So here's new help—especially in planning substations where increasing population densities are making transformer noise a real problem. This is welcome news, too, for noise-sensitive areas such as schools and hospitals. In addition to investment savings and improved public relations, consider the advantages of new flexibility in interchange of equipment, and new ease in obtaining rights of way and substation sites.

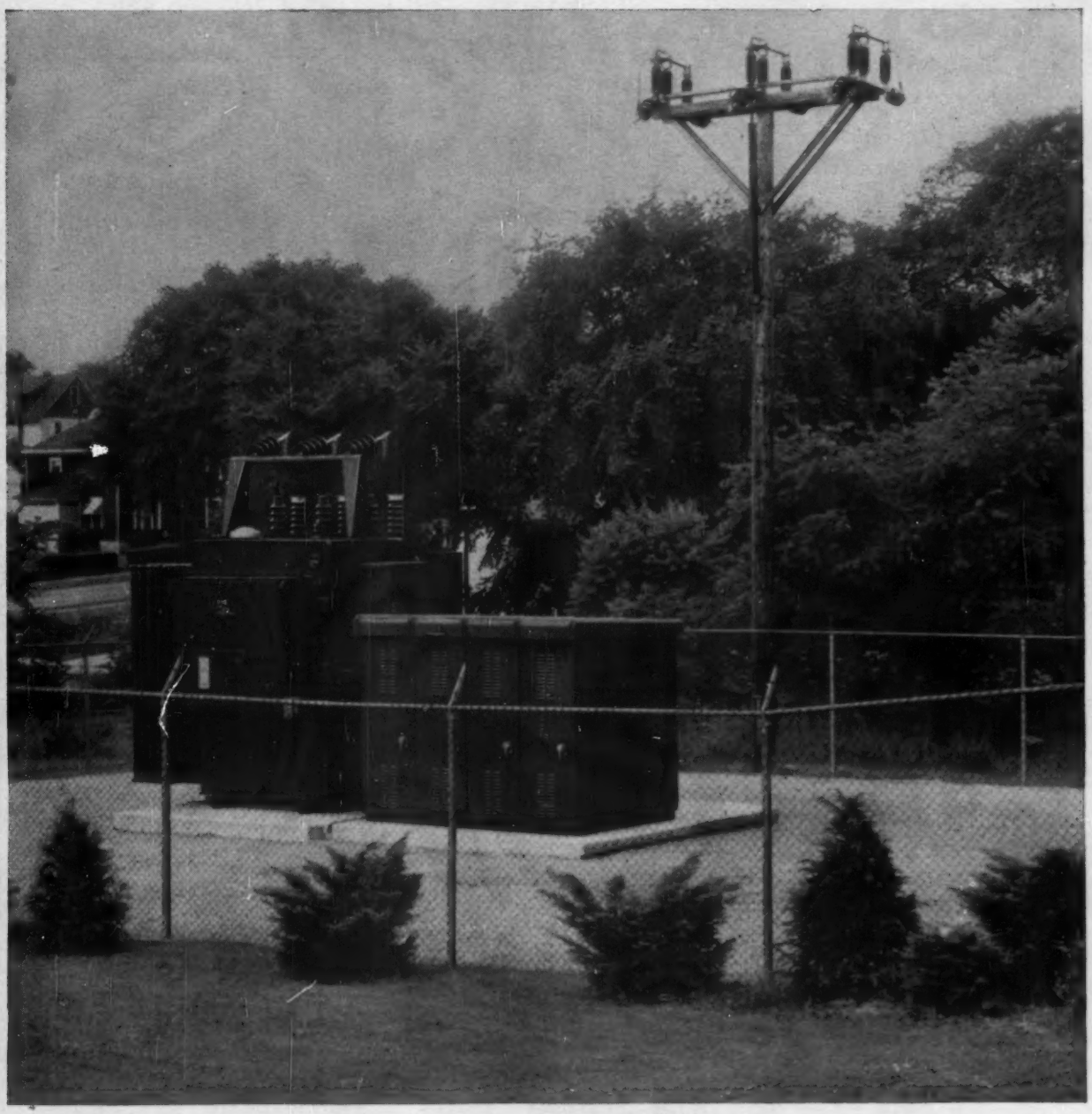
Anticipated power transformer purchases over the next five years total 300,000,000 kva. Based on this figure, reduction in soundproofing "extras" can reach $30,000,000. This is the performance Westinghouse can deliver—with all new power transformers.

For the full story, call your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-70785

Westinghouse now offers you a $11,730 saving on equipment ordinarily invested to cut transformer noise at a typical 10,000 kva neighborhood substation such as this . . . a saving equal to 25% of total equipment cost.

YOU CAN BE SURE... IF IT'S

Westinghouse®



RECOMMENDED NEMA SOUND LEVEL DB.	PER CENT PRICE ADDITIONS FOR REDUCTION IN RECOMMENDED NEMA SOUND LEVEL OF									
	3 DB.		6 DB.		9 DB.		12 DB.		15 DB.	
	OLD	NEW	OLD	NEW	OLD	NEW	OLD	NEW	OLD	NEW
56 to 60	22	6	41	9	—	—	—	—	—	—
61 to 65	14	5	25	7	55	14	—	—	—	—
66 to 70	8	4	15	5	35	10	—	—	—	—
71 to 75	4.5	3	9	4	20	7	35	14	—	—
76 to 80	2.5	2	5.5	3	11	5	19	10	39	20
81 to 85	2	1	3.5	2	6	3	12	6	23	12
86 to 95	—	1	—	1	—	2	—	4	—	8

Drastic reductions in sound levels offered with all new Westinghouse Transformers make possible the above reduction in premiums previously necessary to achieve these same levels.

No bending problem here, because...

ROEBLING PAPER POWER CABLE WITH TELLURIUM LEAD ALLOY SHEATH HAS 4½ TIMES GREATER BENDING LIFE!

Roebling electrical wires and cables are available with either copper or aluminum conductors.

Yes, Roebling Paper Power Cable with tellurium lead alloy sheath takes that much more bending punishment than cables with copper-bearing lead sheath! And that's been proved time and again, not only in Roebling's laboratory bending fatigue test machine, in which lengths of cable are literally bent to death, but in field use over extended periods.

The uniform character of every inch of sheath and its high resistance to age-hardening, plus its unique stability under heat, assure long life under unusually severe conditions.

But there's an "inside" story to this cable, too. For the superior properties of this sheath are combined with a carefully constructed and tested inner cable made to meet the most stringent use demands. That's why, more and more, this cable is specified by name wherever cable has to last a long, long time.

Write for the full, interesting story today!

ROEBLING

JOHN A. ROEBLING'S SONS CORPORATION
Trenton 2, N. J. • Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Here's MORE Progress in Switchgear from Allis-Chalmers

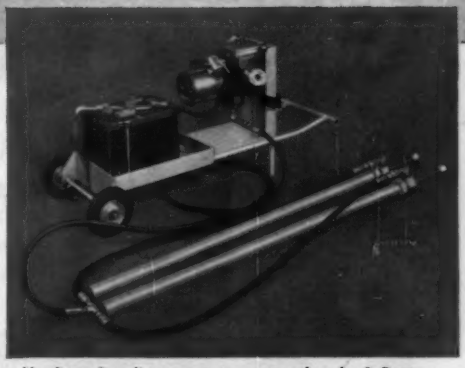
NOW Power-Operated Hydraulic Tank Lifter

Available for Allis-Chalmers intermediate breakers. Another example of Allis-Chalmers progress in simplifying maintenance while increasing safety. Costs no more than hand windlass type, yet cuts raising and lowering time by 80%.

Turning the needle valve completely controls operation and tank may be stopped in any position. Safe even if the hose or fittings are removed during operation.

Pressure energy is obtained from accumulator, power pump or hand pump of *Pneu-Draulic* system.

This is only one of many features of Allis-Chalmers all-new intermediate outdoor oil circuit breakers. Find out more by calling your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



No *Pneu-Draulic* operator on your breaker? Battery operated hydraulic tank lifter is available. Same cylinder and flexible hose. Same operating characteristics.

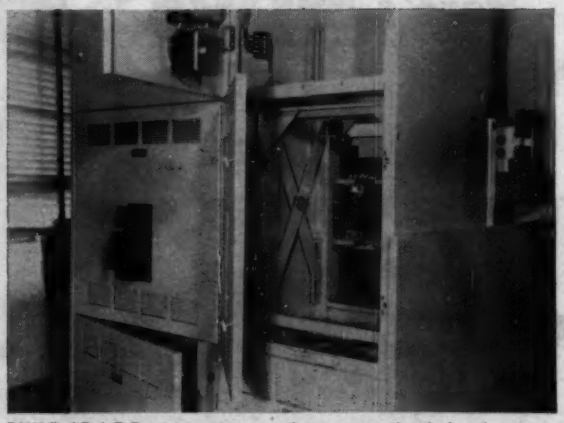
Pneu-Draulic is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-5124

SECONDARY UNIT SUBSTATIONS

ENGINEERED AT I-T-E and coordinated to meet the operating conditions found in your plant.

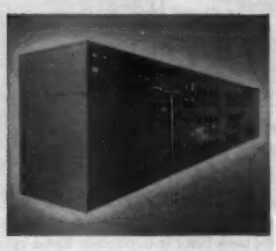


BUILT AT I-T-E with such extra features as circuit breaker test-position with doors closed.

TESTED AT I-T-E to assure ease of installation, and top performance under operating conditions.

SHIPPED FROM I-T-E to assure prompt delivery of one complete "package," ready to install.

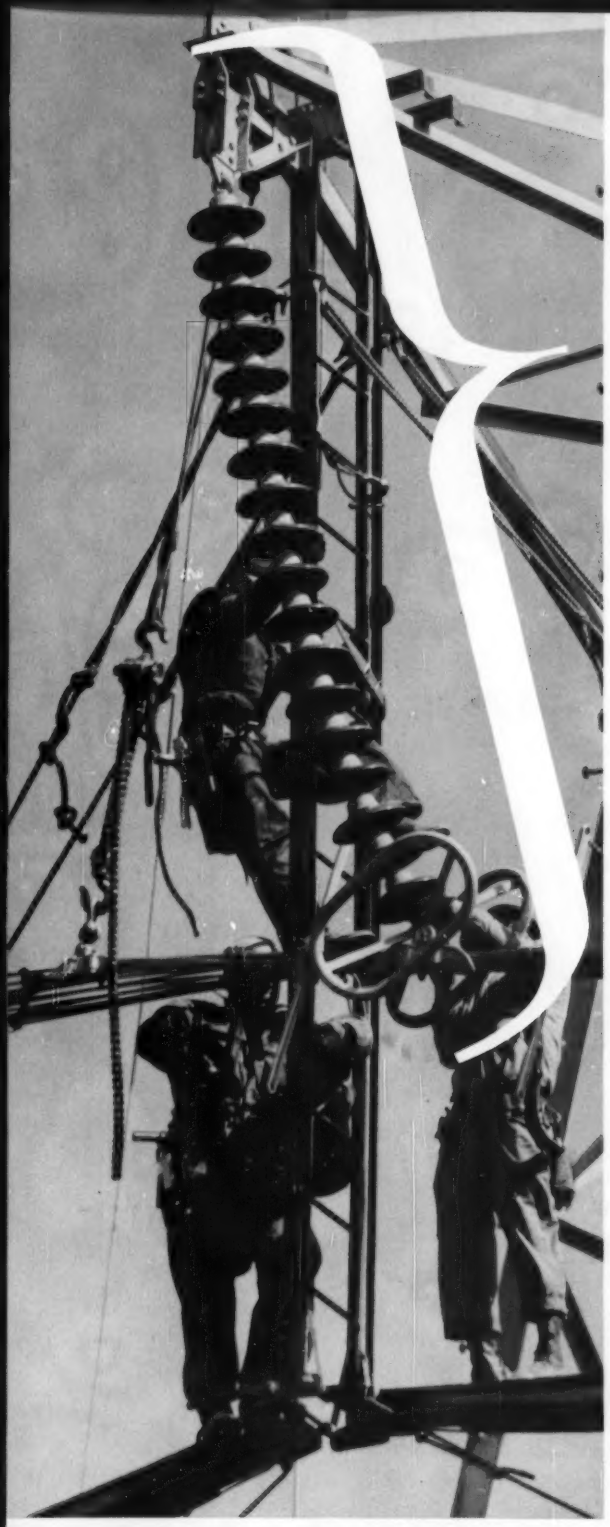
I-T-E MAKES IT EASY TO BUY COMPLETELY COORDINATED UNITS



Only I-T-E builds transformers and switchgear in the same plant. This permits them to assume all responsibility for your unit substation requirements. Close association of engineering and production relieves you of detailed planning, paperwork, and the problems of coordinating deliveries. Shipment is from one location. Installation is speeded. Substation components are completely integrated to provide top performance at low overall cost.

Typical of the extra value which *only* I-T-E Unit Substations offer is circuit breaker test-position with doors closed—and without removing them. This means additional safety to operating personnel, greater cleanliness, simplified tagging out of circuits, and longer life. I-T-E Secondary Unit Substations can be supplied for any application, indoor or outdoor, and in any standard rating. For details, contact the I-T-E sales office nearest you. Or write I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division



Everything—from the hook at the top to the suspension clamp on the bottom—fits together, works together in this insulator string. One good reason—it all comes from one manufacturer.

Everything between the crossarm and the conductor.

made by one manufacturer to serve you as a unit

Everything in this string of insulators—from the hook at the top to the suspension clamp at the bottom—came from one manufacturer. They're designed, made, and tested together.

What's that mean to the insulator buyer? It means he can hold one manufacturer responsible for the performance of the entire string. Knowing this, the manufacturer studies hardware and insulators as a unit, makes them to perform as a unit. Everything is done in terms of achieving the right relationship between porcelain and hardware. Foremost consideration is not how well the hardware will perform, or how well the porcelain will insulate, but how well they will work together in doing their job.

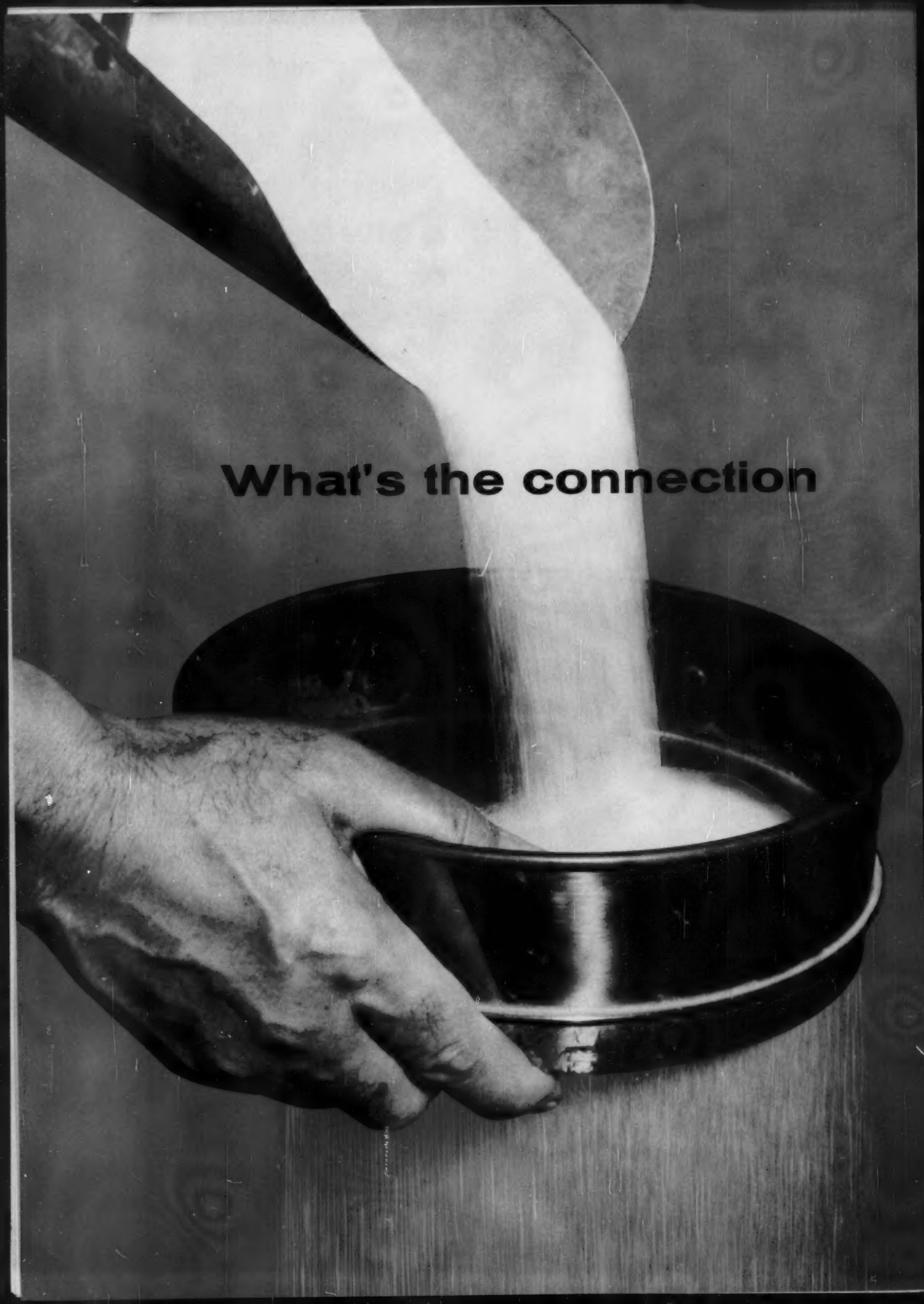
If you think such considerations are important, come to the one company that makes both insulators and hardware—Ohio Brass.

OHIO BRASS COMPANY, MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Ohio Brass

B


What's the connection

between grain size and insulator performance?

It can be the key to insulator strength and uniformity

Homogeneity is a basic goal in porcelain manufacture. The more homogeneous the porcelain the greater the mechanical and electrical strengths, the more accurate and uniform the product, and the longer the performance of the insulator when installed on your lines.

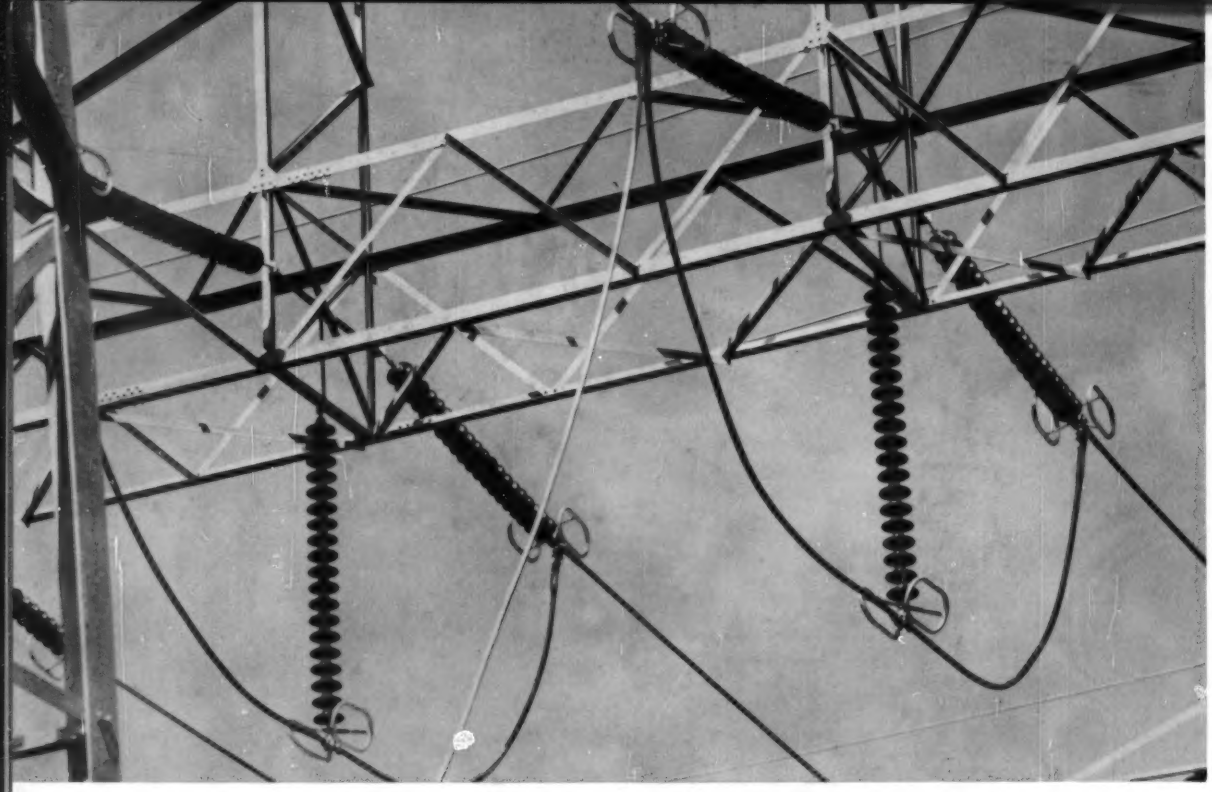
One way we achieve homogeneity is by buying flint and feldspar in the finest grain sizes commercially available. Why is grain size important? Ordinary grains of flint and feldspar are many times the size of clay grains. By using fine grains of flint and feldspar, we reduce the differential. During firing we get a homogeneous blend of basic materials. The smaller the grains, the better the blend, the higher the strength of the porcelain.

So checking grain size becomes a key step in making quality insulators. We make sure we have the right building blocks before we start. This is one of many ways that extra years of performance are added to O-B insulators.

OHIO BRASS COMPANY, MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Ohio Brass



O-B insulators and hardware in service at a transmission substation on an extra-high voltage line. O-B studies have shown that insulators and hardware need place no limitation on voltage magnitude in EHV transmission.

When you come to that important five per cent . . . . . .

Remember many answers on insulator and hardware performance at extra high voltage are already available

As you plan or consider using extra high voltage transmission in your system, you'll give careful consideration to the insulators and hardware you use. Although they ordinarily constitute less than five per cent of the line cost, they're an important five per cent. You'll want to get your own answers on what combination does the best job under the specific conditions that prevail along your lines.

O-B already has many of the answers on insulator and hardware performance. For example, we know they place no limit on the magnitude of transmission voltage. We've already used our materials successfully in various bundled conductor arrangements.

We're prepared to relate our findings to your problems. If the answers still aren't apparent, we have the facilities for duplicating the operating conditions which you will encounter.

So there's no advantage in waiting to get the benefits of extra high voltage transmission. We're ready to help you go ahead—right now!

OHIO BRASS COMPANY, MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

4742-H

Ohio Brass

B

1957—The Year to Drive Housepower Home

This month the Edison Electric Institute's "Housepower" program moves into its second year.

In the 12 months that have elapsed since formal announcement was made of its inauguration (EW, Jan. 16, 1956, p 10) Housepower has emerged from its organizational phase and advanced purposefully toward the goals laid down by its founders:

1. To dramatize to the electric service customer the penalty he is paying in discomfort, inconvenience, and expense because of his outmoded wiring.

2. To supply a new and broad wiring promotional base in which not just the utilities but the whole industry can participate.

The measure of the success of the Housepower program in living up to these objectives during its pivotal first year is clearly seen in the following record of accomplishment:

- Nearly 30 manufacturers of electrical equipment and supplies contributed $90,000 worth of merchandise prizes to the national $100,000 Housepower Contest, which attracted 316,771 entrees.
- Three associations whose goals are akin to those of Housepower spent nearly $80,000 in tie-in advertising to promote aims of the program.
- For each $1 Edison Electric Institute spent to promote Housepower, manufacturers spent $3.
- A public opinion survey disclosed that Housepower in less than seven months achieved 38% recognition as a name the public knows.

The industry may well be proud of this initial achievement. But satisfying as it has been, a second and critical phase of the program lies immediately ahead. In 1957 the industry has been asked to achieve five basic objectives:

1. To build a wider consumer recognition.

2. To increase trade ally support and enthusiasm.

3. To integrate Housepower with other industry programs.

4. To concentrate on accelerating local selling.

5. To show specific results in more rewired homes.

These objectives call for intensive local selling effort. Results in 1957 will depend on performance of individual companies in their own home territories. They will depend pretty much on what individual sales departments do with the excellent promotional tools being developed by the Housepower staff organization and committees. They will depend on how each company builds on the groundwork already laid by the national advertising program—to convert consumer education into sales and rewired homes through intensive local selling.

Whether the program's second year is as successful as its first depends on what we do with Housepower—at home!

Install Capacitors Underground—Carefully

The idea of installing primary capacitors below ground in vaults, hand holes, and junction-box enclosures is a stimulating one that may contribute substantially to clearing today's growing pole-top congestion and alleviating cable loading conditions due to air conditioning.

Caution must be the watchword in such installations. Thermal characteristics of primary capacitors are such that particular attention should be paid to their operating temperature when enclosed.

The National Electrical Manufacturers Association makes these fundamental points on capacitor operating temperature in its Standard for Shunt Capacitors CA 1-1955.

". . . Capacitors are designed to operate at a lower temperature rise than most other types of apparatus for the following reasons:

"Capacitors operate at full load continuously, which eliminates the benefit of an average temperature rise derived from the usual load cycle under which most other apparatus operates.

"Capacitors are designed to operate at comparatively high dielectric stresses for reasons of economy. The combination of these stresses with operation at high temperature for extensive periods of time will result in gradual deterioration and shortened life. . .

". . . Consistent with expected long life and as a rough guide, it is recommended that the temperatures at any point on the case shall not be permitted to exceed 55C (131F) under the usual operating conditions or 70C (153F) under the maximum permissible operating conditions. . .

". . . Pole-mounted equipments consisting of individual units rated 15 kvar but not exceeding a total of 180 kvar, mounted-in-housings without forced ventilation are suitable for operation at ambient temperatures up to and including 46C."

These fundamental precautions, and others relating to submersible operation of capacitors installed below ground, merit close and meticulous attention.

As we see it, capacitors are an important tool for combatting heat storm effects on underground systems growing out of high concentrations of air-conditioning load. It seems logical that below ground installation of primary capacitors will increase. But it would be unfortunate indeed if such installations fell victim of the underground heat storm effects they seek to alleviate.

Winter Peak Lower Than Expected;

Demand climbed 4.45% Last Year . . .

EW survey of 86 utilities shows less than half set new peaks. Some expect higher loads this month

Company	1956 Winter Peak Load Kw	Increase Over 1955–6 Winter Peak Kw	%	%Over Predicted Winter Peak	%Over 1956 Summer Peak
Alabama Power Co.	1,293,000	84,800	7.02	−1.07	− 4.20*
American Gas & Electric System	3,745,000	233,000	6.64	−3.97	7.18
Atlantic City Electric Co.	239,500	2,700	1.14	−4.2	−10.0*
Baltimore Gas & Electric Co.	821,000	50,000	6.5	−0.5	2.0
Boston Edison Co.	819,040	−5,425	−0.7	−4.3	19.8
Brockton Edison Co.	75,800	1,800	2.4	−4.0	37.0
California Electric Power Co.	191,600	11,600	6.4	−2.2	− 6.8*
Carolina Power & Light Co.	902,000	24,000	2.73	−3.63	2.5
Central Maine Power Co.	344,000	−5,235	−1.5	−8.9	10.0
Central Vermont Public Service	97,500	−2,900	−2.9	−1.5	5.6
Cleveland Electric Illuminating	1,249,000	26,000	2.13	1.2	4.5
Commonwealth Edison Co.	3,735,000	200,000[a]	6.0[a]	−0.7	6.0
Connecticut Light & Power Co.	653,061	−7,813	−1.18	−4.72	20.8
Consolidated Edison Co.	3,241,000	26,000	0.8	−1.8	1.2
Consumers Power Co.	1,570,800	112,730	7.75	0.05	13.61
Dallas Power & Light Co.	344,900	29,700	9.4	−2.8	−43.4*
Delaware Power & Light Co.	299,137	16,415	5.81	−3.84	2.36
Detroit Edison Co.	2,475,000	12,000	0.5	−10.0	11.5
Duke Power	2,036,135	101,755	5.26	−3.13	− 0.22
Duquesne Light Co.	1,106,000	30,000	2.8	−1.7	5.0
EEInc & OVEC	3,390,000	202,000	6.34	−0.73	1.56
Florida Power Co.	511,000	5,700	1.13	−1.22	17.58
Florida Power & Light Co.	855,100†	115,100	15.6	0.6	18.9
General Public Utilities	1,718,900	69,100	4.19	−2.89	11.45
Georgia Power Co.	1,606,540	62,940	4.1	−3.9	− 5.8*
Hartford Elec. Light-Conn Power	319,900	13,900	4.5	−2.2	20.7
Kansas City Power & Light Co.	510,000	30,000	6.25	0.4	−16.4*
Kansas Gas & Electric Co.	325,000	39,500	13.8	−2.4	−19.1*
Long Island Lighting Co.	744,500	42,200	6.0	−6.1	26.3
Los Angeles Dept Water & Power	1,268,000	81,000	6.82	−0.16	21.45
Louisiana Power & Light Co.	319,000	35,000	11.9	−0.3	−10.9*
Mississippi Power & Light Co.	264,289	5,477	2.1	−7.3	−24.8*
New England Electric System	1,222,000	2,000[b]	0.2	−0.3	16.3
New Orleans Public Service Inc.	231,000	24,000	11.1	−3.0	−26.2*
New York State Elec & Gas Co.	708,090	25,920	3.80	−3.27	18.9
Niagara Mohawk Power Corp.	2,746,900	4,500	0.16	−0.15	11.37
Northern States Power Co.	1,171,495	73,645	6.7	1.0	19.6
Ohio Edison System	1,428,000	76,700	5.68	−3.90	13.9
Oklahoma Gas & Electric Co.	442,500	34,000	8.3	−8.0	−20.6*
Pacific Gas & Electric Co.	3,916,900‡	345,700	9.68	−0.89	− 4.12*
Pacific Power & Light Co.	812,400	45,900	6.0	1.5	27.6
Pennsylvania Power & Light Co.	1,332,500	57,600	4.52	−0.4	5.5
Philadelphia Electric Co.	2,195,000	−35,000	−1.6	−5.0	6.0
Portland Gas & Electric Co.	748,000	7,000	0.9	−1.3	36.2
Potomac Electric Power Co.	711,000	31,000	4.56	−3.14	−17.62*
Public Service Co. of N. H.	256,400	−2,400	−0.9	−5.0	6.1
Public Service Electric & Gas	2,061,000	39,000	1.9	−2.3	5.4
Puget Sound Power & Light	533,000	50,000	10.4	9.9	38.4
Rochester Gas & Electric	318,000	9,700	3.1	−2.7	10.2
Seattle City Light Dept.	759,000	26,000	3.55	−0.65	32.5
South Carolina Electric & Gas	393,000	16,000	4.2	−7.1	− 4.4
Southern California Edison	2,504,000	219,100	9.6	0.16	7.6
Southwestern Gas & Electric	291,000	19,000	7.25	2.1	−37.8*
Tacoma City Light Dept.	381,000	14,000	3.81	−6.39	27.42
Tennessee Valley Authority	8,574,000	276,000	3.3	−5.47	12.6
Union Electric Co of Missouri	1,225,000	7,000	0.6	−6.0	−13.0*
United Illuminating Co.	327,100	10,100	3.28	−3.22	9.93
Utah Power & Light Co.	526,300	39,035	8.0	−3.8	11.9
Virginia Electric & Power Co.	1,213,000	64,000	5.6	−4.5	3.5
Washington Water Power Co.	563,000	26,000	4.8	1.8	24.3
West Penn Electric System	1,519,000	76,000	5.26	−2.63	9.81
Western Mass. Electric Co.	245,000	7,100	2.98	5.69	11.44
	76,425,487	3,263,644	4.45	−2.56	6.14

([a]) Increase is about 200,000 kw in customer load; system peak shows only 75,000 kw increase because of reduction in firm supply to other utilities.
([b]) Increase is about 2,000 kw in customer load; generation dropped because of 75,000 kw reduction to other utilities.
* Load Peaks in Summer. † "Normalized figures". ‡ Includes sale to other systems.

Mild weather across the country was blamed for holding down utility peaks during the usual pre-Christmas peak-load period. So sharp was the effect that less than half the utilities consulted by Electrical World set new peaks in the customary period and several of these were below their peaks for the same time last year. Eleven utilities reported heavier loads during a November cold spell than in December.

Load Climbs in '56

Preliminary load data collected by Electrical World indicate that the 1956 non-coincident winter peak of Class I utilities will show a 4.45% increase over their 1955 peak of 98,291,000 kw. This represents a 4,380,000 kw increase which, when other than Class I operations are added, will boost the industry total to a figure of about 106,000,000 kw.

This estimate is based on a survey covering 86 utilities which produce nearly 75% of the power sold by all Class I utilities, including those serving the AEC. This group of utilities reported peak loads aggregating 76,425,487 kw for an increase of 3,263,644 kw or 4.45% over 1955. This increase was 2.56% below the sum of individual company estimates but many companies expressed confidence that colder weather in January would justify their predictions.

Capacity Grows Comfortably

Generating capacity additions exceeding 5.7 million kw comfortably accommodated this growth in peak load and restored better than 1% to capacity margin, reversing the trend of recent years. Capacity additions for 1957 are estimated at upwards of 10 million kw.

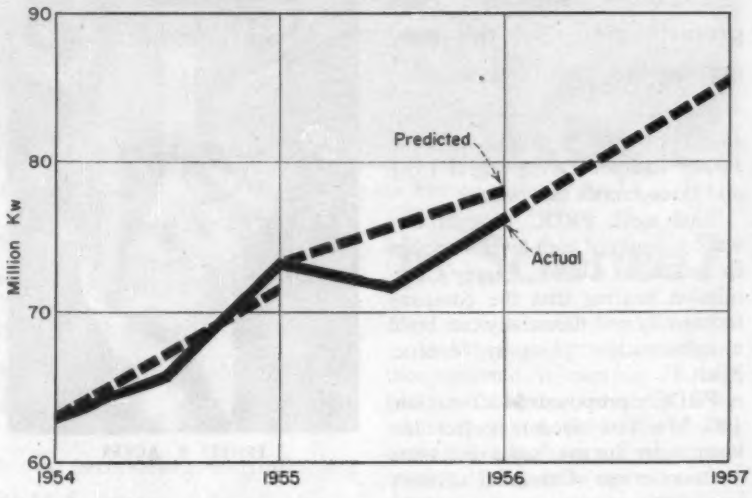
Factors other than mild weather blamed for cutting the pre-Christmas peaks were delay in connecting Christmas lighting and local slowdowns in industrial activity. The former was mentioned by six com-

Mild Weather Blamed

panies in the Northeast which opined that the frequent rains before the holiday induced many people to take advantage of the long weekend to install home displays. The latter was reported by several companies in the East North Central area as a failure to reach expected industrial load levels, slippage in completing large industrial load installations, and a slowdown in coal mining to compensate for the decrease in consumption caused by sustained warm weather.

Despite the slackened growth, winter peaks exceeded summer peaks for over 80% of reporting utilities. The combined non-coincident peak for the entire survey was 6.14% over summer peaks. But the traditional summer valley shows continued filling at a rate exceeding growth in winter peak.

. . . but Load Fell Short of Prediction 2.56%



TVA Generation Grows 38% in Fiscal 1956

About 57.5 billion kwhr were produced in the 12 months ending June 30, report to Congress shows. Kingston steam station is now the biggest in the world

The Tennessee Valley Authority has nearly completed its construction to provide electricity for atomic defense plants, the agency said in its annual report to the President and Congress. The report covers the fiscal year ending June 30, 1956.

Discussing the year's operation, TVA said the final two generating units at the Kingston Steam Plant were placed in operation during the period, bringing the installed capacity to 1,440,000 kw and making it the largest electric generating station in the world. The report pointed out that Kingston's condensers use as much water as the City of New York. Its boilers consume a 50-ton carload of coal in six minutes.

In discussing power generation, the report said:

"The year brought a new record in power generation of 57.5 billion kwhrs and a new record of sales to the Atomic Energy Commission. The Oak Ridge and Paducah plants, which together use from TVA more than twice as much power as is consumed in the City of New York, took 30.2 billion kwhrs—56% of TVA's total sales.

"The integrated system generation of 57.5 billion kwhrs was an increase of 38% over the year before. Steam-electric stations generated 43.1 billion kwhrs. Because of drought, hydro generation was about 2 billion kwhrs less than expected in a normal year."

The agency devoted a section to its defense power expansion.

This expansion, which added six million kw of generating capacity to the TVA power system in a period of six years, "has brought such striking changes in the nature of TVA operations."

"The AEC plants which earlier had produced essential materials for the bombs of Alamagordo, Hiroshima, and Nagasaki demanded about 300,000 kw of power capacity from TVA in 1950. In fiscal 1956 they required more than 3.5 million kw.

"In terms of electrical energy, the federal agencies, exclusive of TVA itself, multiplied their use of TVA power 15 times over the same period. In 1950, they used less than two billion kwhrs, 14% of TVA's sales. In 1956 they used 30.5 billion."

GE Increases Prices on Small Appliances

General Electric Co raised its prices on a variety of its small home appliances Jan. 2.

The increase follows as a result of GE's discovery that some of its products are priced too low. "Our products are under priced; they're too much of a bargain," said Ralph J. Cordiner, president at a press conference held in December. The increases are dictated by a reported across-the-board increase in production costs.

The company slashed prices on some appliances last year by as much as 30%.

PRDC: Warming Up to the Fight

Expert testimony calls project safe. But this may not be the "real" issue . . .

The gong has rung. The first round of the big fight between Power Reactor Development Corp and three unions has begun.

Last week PRDC brought forward a group of high-level witnesses to assure an Atomic Energy Commission hearing that the company technically and financially can build a safe nuclear plant at Monroe, Mich.

PRDC's proposed $43.2-million, 100 Mw fast-breeder project has been under fire ever since disclosure six months ago of an AEC advisory committee report questioning the safety of the project on the basis of then existing information.

Hearing May Set Precedent

The public hearing is important in another respect: Since it's the first ever held by AEC, it may set precedents for future regulation of the atomic power industry by a government agency.

As to financial ability, Ernest R. Acker, president of Central Hudson Gas & Electric Corp (PRDC member company), and PRDC vice president and chairman of the financial committee disclosed firm commitments for more money than the $43.2-million PRDC will need.

On the technical side, Dr Hans A. Bethe, professor of physics, Cornell University, consultant to Atomic Power Development Associates (affiliate of PRDC), testified that the fast breeder, is in many respects safer than thermal reactors.

Bethe was supported by Dr Norman Hilberry, deputy director of Argonne National Laboratory, AEC's Reactor Division Chief W. Kenneth Davis; Walter J. McCarthy, Jr, head, nuclear engineering section, APDA; and Alfred Amorosi, technical director, APDA.

All this testimony at last week's one-day hearing was presented in written form by PRDC witnesses without the witnesses themselves

ERNEST R. ACKER

present. The three labor unions opposing PRDC were given until Jan. 18 to study this testimony and present their objections.

On Jan. 28 the hearing reconvenes for oral argument on objections. After this, cross-examination of PRDC witnesses by union lawyers.

The hearing originally was called at the request of: The United Automobile Workers; the International Union of Electrical, Radio, and Machine Workers; and the International Union of United Paperworkers of America, all AFL-CIO.

AEC May Be Issue

They charged that the AEC acted illegally in issuing a construction permit last Aug. 4 to PRDC for the proposed reactor because it is "inherently unsafe." They said further, that PRDC had not shown that it was financially qualified to build a safe project.

While AEC granted the request for hearing, it specified that the issues to be heard by examiner J. A. Kyle should deal only with the safety of PRDC's proposed project and the company's financial ability to undertake it.

The commission would not allow any discussion of the legality of its own actions. But this promises to become a lively issue as the hearing progresses, since this is the unions' main target at the hearing.

Benjamin C. Segal, union attorney, promised that he would raise the "real" issue; AEC's alleged illegal O. K. of the PRDC project.

AEC has established a separate legal staff to get "all the relevant facts" into the record.

The importance of the fast breeder is that it will produce more fuel than it consumes. Success of this reactor design is considered necessary to the existence of a large atomic power industry.

Reactor Safety Cited

Bethe's testimony disposed of some fears about the PRDC reactor. "It is impossible," he said, that a reactor of this type could "ever explode like an atomic bomb." At worst, a reactor accident "would be comparable to a boiler explosion in a conventional power plant."

He added that the chances of radioactive substances being released into the air "is incomparably smaller than that of the most freakish accidents we occasionally read of in the newspapers."

Hilberry said there was "no credible possibility" that the reactor could be a bomb; that experimental work now underway at Argonne and Los Alamos scientific laboratory would show that the "maximum" possible accident of the PRDC-type reactor could be contained; that the PRDC reactor "can be constructed and operated in a populated community without undue risk to the public." (Bethe said the same thing.)

Davis of AEC stated that before the PRDC reactor is completed, AEC's second experimental breeder reactor (EBR-II) and the British fast breeder at Dounreay, Scotland, will be in operation.

Amorosi testified that late design changes in the interests of greater safety would come to no more than $2.7-million.

Before the PRDC reactor will be operated, the company and AEC are going to guarantee that as the temperature of the reactor rises, the reaction will automatically be slowed down.

"Russian science is getting inspired leadership"

"But the Soviet plan has an Achilles heel . . ."

Will Russia Outstrip U. S. in Science?

Prof John Turkevich, a Princeton University expert on Russian science, says in exclusive interview that USSR intends to wrest scientific leadership from the U.S.

To do this, the Soviet Union is promoting engineering heavily, and is "catching up" with U. S. now

The Soviet Union now is in the "catching up" stage of an all-out program aimed at stripping scientific and technological leadership from the United States. In a few scattered areas, Russian science even may have reached the "leadership" stage.

But the big army of engineers and technicians now being mustered behind the Iron Curtain does not necessarily menace U.S. supremacy in technological fields. The real threat lies in a recent emergence of new scientific leadership — leadership which is inspiring the ranks with a spirit of enthusiasm that was crushed out during Stalin's 40-year administration of the "dictatorship of the proletariat."

Those are the observations of one of America's foremost scholars of Russian science—Prof John Turkevich of Princeton University.

Turkevich's facility with the Russian language and his insatiable interest in Soviet science have won him national recognition. He is a consultant to the Atomic Energy Commission, and was an advisor on the U.S. delegation sent to the Geneva conference.

In an interview with Electrical World, this dynamic 50-year-old physical chemist said that the new scientific leadership in Russia springs from the old intelligencia.

"This is the class that produced in the early 20th Century the great Russian writers and composers. These men think as we do. They are highly refined. They're not scientific palookas."

Russian Science Grows Stronger

Evidence is piling up that Russians are gathering scientific strength. They have the men. They have the money and facilities. They produced an atom bomb. They created atomic reactors and accelerators. Now they're getting the leadership they need. Today they're in a better position to challenge the United States for world leadership in science.

For the last two decades, the Soviet Union has been making a determined effort to produce more and better engineers. The number of Russian engineering graduates rose from 30,000 in 1952 to 63,000 in 1955, while in the U.S. the number of graduating engineers dropped from 30,000 to 23,000.

But Turkevich said the U.S. should answer this challenge not by turning out more engineers but by turning out better engineers.

Turkevich believes that before Russia can be scientifically powerful, it must endow its scientists and engineers with professional independence. Scientific independence is prerequisite to scientific leadership.

Already there are signs that more independence is coming. It will bring with it readjustments in the whole Soviet society—for during Stalin's regime, science was inextricably enmeshed with political dogma.

If Russia's leaders are able to prevent an explosive reaction as they grant more scientific independence, then gradually a spirit of independence will spread to other phases of Russian intellectual and political life, Turkevich believes. This slowly will make for a more democratic system in which the rights of individuals are protected.

Achilles Heel Threatens Peace

But Russia's plan for revitalizing science has its own Achilles heel. As Russia encourages more of its young people to pursue the logical sciences, it will become more difficult to sell communism with emotional appeals. Disparities in what students hear in the classrooms with what they see in the streets may foment a rebellion that ultimately may threaten stability of the Soviet government. This may be a potential trigger for World War III. Turkevich said the U.S. must remain strong during these adjustments in Russia.

Will Russia outstrip the U.S. in science? Russia has received only one Nobel prize since 1904. Significantly this award was made in 1956 to N. N. Semenov for his work on chain reactions. Soviet science definitely is on an upward swing. U.S. leadership in the future may well depend upon the degree of its ingenuity.

U. S. Leads in Atomic Power, World Opinion Survey Shows

Poll taken in 11 foreign countries indicates U.S. prestige ranks well above Britain and Russia in the development of atomic power and peaceful use of atom

The United States is generally recognized as the world leader in the development of civilian nuclear power. Britian ranks second. Russia runs a poor third. That's the finding of an international public opinion survey published last week by "Nucleonics", a McGraw-Hill magazine.

This sampling of world opinion on U. S. nuclear efforts is almost certain to attract the attention of Congress within the next few weeks as the Joint Committee on Atomic Energy settles down to review this country's progress in the field. It's likely to play a part, too, in debates over the future course of the U. S. development program.

Opinion Could Influence Policy

Proponents of a larger federal development program, as opposed to the present non-federal program, argue that the government must seize the initiative if it is to retain its prestige in the field. The House last year defeated a Senate-approved bill which called for a $400-million federal program for power reactor development. Similar legislation is almost certain to come before the present Congress. Outcome of these efforts could very well hinge on the present and future position in world opinion which the U. S. holds in development of nuclear power.

The "Nucleonics" survey indicated that the U. S. holds a stronger public opinion lead over Great Britain and Russia in the general peaceful uses of atomic energy—in medicine, biology, and agriculture —than in the specific field of nuclear power generation.

In interviews with 102 persons in 11 countries of the free world, 52% of those questioned thought the U. S. was the world leader in the development of atomic power. In answer to the question: "By whatever standards you use, what country do you consider the world leader in the development of civilian nuclear power?" The U. S. received slightly more than a majority of the votes. Great Britain was second with 40% and the Soviet Union was a poor third with only 8% of the votes.

The McGraw-Hill correspondents polled atomic energy officials, editors and opinion formers, industrial leaders now in the atomic energy field, and men-in-the-street in 11 countries. Countries covered were Australia, Austria, Brazil, France, West Germany, India, Italy, Japan, Lebanon, Mexico, and Spain.

As the chart shows, the Soviet Union received its highest percentage of votes among editors and opinion formers, and men-in-the-street.

Of atomic energy officials in the 11 countries covered, 50% thought the U. S. was world leader, 45% thought Great Britain was ahead, and 5% saw the Soviet Union as top runner. Industrial leaders in the atomic energy field also gave the Soviet only 5% of the first place votes on this question. However, these industrial leaders, who represent potential customers for power reactors, gave 55% of the first place votes to Great Britain and only 40% to the U. S.

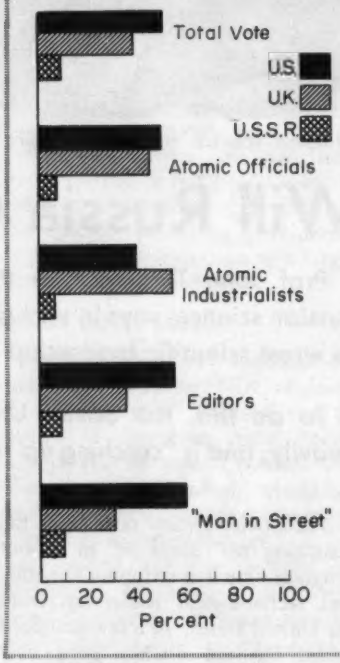
Editors Impressed by U.S.

Editors and opinion formers gave 56% of their votes to the U. S. as front-runner in the nuclear power field, 35% to Great Britain, and 9% to the Soviet Union. Men-in-the-street answering the "Nucleonics" poll gave 58% of their first-place votes to the U. S., 32% to Great Britain, and 10% to the Soviet Union.

The poll was taken in October of last year, and the publicity associated with the opening by Queen Elizabeth of the Calder Hall station undoubtedly accounts for some of the increase in the first place votes recorded for Great Britain. However, the most significant swing in votes for leadership in power, as contrasted with peaceful uses generally, occurred in the class composed of industrial leaders now either in atomic energy or priority customers for atomic power reactors, where the straight publicity impact would be expected to be less than on technically-less-informed people. The contrary was the case.

Several questions were used to shed light on the knowledgeability of the respondents. Asked if they knew of any countries in the world now operating nuclear reactors designed primarily for the purpose of producing useful power, 77% said "yes" and 23% said "no." Some of the 77% voting "yes" listed more than one country. Relative to the total listing of the countries, Great Britain received 31% of the mentions; the USSR, 24%; the U. S. 22%; France 11%.

"What country do you consider to be the world leader in the development of atomic power?"



AEC Calls Again

. . . for industry-proposed reactor projects to be built with federal assistance

Atomic Energy Commission Chairman Lewis L. Strauss has invited public and private power groups again to propose reactor projects that will help speed the nation's development of nuclear power.

Acceptable projects will be eligible for AEC assistance under a liberalized program which Strauss suggested in December.

Groups submitting proposals must finance plant construction, but the AEC will help with research and development. Furthermore the AEC will waive for five years, under some circumstances, charges it normally levies for use of nuclear materials in reactors.

This is the third invitation issued under the commission's power demonstration reactor program—but the first since Strauss urged new steps to encourage greater efforts at developing peacetime atomic power.

Proposals should be submitted "as soon as possible." Each will be considered when received rather than after all plans are in.

There's no deadline for submitting proposals, but under the plan all proposed plants must be completed by June 30, 1962. There's no restriction on type or size of reactors either, although the AEC pointed out it is particularly interested in reactors fueled with natural uranium and moderated by heavy water, or plants using a fluid fuel based on solutions of uranium or uranium and other materials containing thorium.

Meanwhile AEC ruled out three of seven recent proposals for small power reactors. Two were dropped because technical feasibility has not been demonstrated, and more research and development is needed. These include a 12.6-Mw gas-turbine, nitrogen-cooled reactor proposed by Holyoke, Mass., and a 25-40-Mw liquid-metal-fueled reactor proposed by Orlando, Fla. The third proposal, a 500-kw pressurized water reactor for the University of Florida, was "too small" to qualify.

Shippingport Gets Laboratory Checkup

This quarter-scale model of the Shippingport nuclear reactor is yielding fluid flow data in experiments conducted for Westinghouse Electric Co by Battelle Memorial Institute, Columbus, Ohio. Fans at left force air through this model. In the full-sized reactor, water actually will do the core-cooling job. Air pressure is measured here at 350 separate points. This study will tell whether the cooling fluid will circulate properly in the actual reactor.

NUCLEAR NOTES

Argonne National Laboratory set a milestone recently as the first facility to generate nuclear electricity under the Atomic Energy Commission's 1954 civilian power reactor development program. The Lemont, Ill., plant, with its boiling water reactor, "generated electrical power at its full design rating of 5,000 kw. . . in a test run," said AEC.

Britain's Atomic Energy Authority has established a commercial department to handle sales and to fix prices for uranium, plutonium, thorium and graphite. Under the new arrangement, Central Electricity Authority and other civilian customers would buy nuclear materials and AEA has the option of buying back spent uranium.

AIEE, New York, & Scalpers

Before the week is out, another pilgrimage to New York will have begun as engineers from all parts of the United States depart for the American Institute of Electrical Engineers' Winter General Meeting which begins Monday at two hotels.

About 5,000 members or more will snap up about 1,800 hotel rooms for the week, while the Institute takes over about 28 for technical sessions and committee meetings.

Delegates will find evening theater prices riding high this year. Legitimate ticket brokers are selling "Li'l Abner" for $9.15 a seat and "Damn Yankees" for $8.60. Hard-bitten New Yorkers will point out, however, that these prices are low. Less-legitimate "scalpers" are said to get as much as 75 bucks per.

Aside from big money deals, delegates may find a Wednesday morning session on research of some interest. "Opinions of Electrical Engineering Graduates Regarding Employment Opportunities" is the subject of one paper.

Delegates also will find two new sessions introduced this year: Satellite Telemetering, and Satellite Communications. Both are scheduled for Jan. 24.

At Monday's big general session, Dr Comfort A. Adams is to receive the Edison Medal "for pioneering achievement in the development of alternating current electrical machines, and in electric welding. . . ." The 88-year-old retired Harvard University professor is the oldest living past-president of the Institute.

Thursday afternoon, the AIEE will meet jointly with Engineering Institute of Canada, Montreal, and the Institution of Electrical Engineers in London via trans-Atlantic telephone cable. Prominent engineers and scientists in the three cities will take part in discussions. Delegates will eavesdrop via loudspeakers.

Freeing Trees From Conflict

Philadelphia Electric has enlisted an arborist to help it solve the perennial conflict between trees and overhead lines. PE's aim is to aid municipalities in its service area in planting properly selected trees which would not only beautify the area but reduce the presently high cost of trimming. Maintainance of economical and reliable service is also listed as an advantage of the program.

Rain Falls on Bonneville

Bonneville Power Administration had some good news recently for many of its industrial customers. Heavy rains in the Pacific Northwest had filled up reservoirs so that nearly all hydroelectric plants were up to normal generating capacity. BPA said it was restoring 250,000 kw to its system on an interruptible basis.

During the shortage, many of the big industrial consumers bargained with BPA for low-cost power, but agreed to replace it later by buying high-cost steam or curtailing their consumption if rain did not fill up BPA's reservoirs.

Supervisors Go Formal

Indianapolis Power & Light Co has dropped its informal on-the-job supervisory training. To take its place eight half-day sessions for first-level men cover company history, organization, and development.

Department heads give students first-hand information on their sections' activities, problems, and relationships with other departments. Personnel matters gain special attention. And details on production, system operation, financing, and load-building are among discussion topics to help supervisors find their proper place on the management team.

Trouble on the Cowlitz

The clatter of picks and shovels along the Cowlitz River in Washington has died down in recent weeks as court actions have all but bound and gagged Tacoma Utilities Dept's Mayfield Dam project. Employment has dropped to less than 100 while the state supreme court mulls over the legality of the $37.1-million project.

This case centers around the city's right to buy and replace a hatchery on the river. Another focal point for dispute is a 1909 law stipulating dams cannot be built on a river where they might interfere with navigation.

Meanwhile, the state fisheries department brought suit against Tacoma for cluttering up the riverbed with rock piles that obstructed fish spawning runs. Superior Court dismissed this action later, however, when it found that a large rock deposit at one point in the river resulted partly from work done at the request of the fisheries department to protect fish life, and that other rock piles were "inconsequential."

Concurrently, the state sportsmens council was circulating a petition aimed at outlawing high dams on the Cowlitz and other Columbia River tributaries. Reportedly it collected 85,000 signatures. But Secretary of State Earl Coe rejected the petition. He said a "new state law" requires 90,319 signatures. The sportsmen say the petition is valid because it was circulated before Dec. 6 when the new law took effect. The previous law required only 50,000.

It appears that the clatter of picks and shovels on the Cowlitz may die down even more before fishing, sporting, power, and political interests reach accord.

Aid to Water Plan

. . . in California seen in use of nuclear power and pumped storage hydro plants

Nuclear power plants and pumped-storage hydro plants may bring nearer to reality the fullest utilization of California's water resources. Use of the nuclear-pumped storage team in the $13-billion California Water Plan was outlined by M. J. Shelton, deputy director, and Fred J. Groat, senior electric utilities engineer, California Dept. of Water Resources, in San Francisco.

A nine-year study behind the plan envisions some 260 dams, power plants, reservoirs, and a cross-state aqueduct system to correct the maldistribution of water within the state. Arrival of nuclear power competitive with conventional steam plants will not curtail the importance of hydro plants in the plan, said Shelton.

Hydro Capacity Demand Seen

Studies show that hydro capacity will be much in demand, primarily because it is well adapted to high-degree peaking operation. With nuclear plants for production of low-cost, off-peak power for pumping, pure pumped-storage projects become a likely possibility.

Shelton pointed out that the full benefit of low-cost nuclear off-peak energy will be realized when the total nuclear generating capacity exceeds system base load, and increasing amounts of nuclear off-peak energy become available. Based on estimates by General Electric Co, it appears that nuclear off-peak energy may become available after 1980.

Therefore, pumped-storage hydro plants may compete more actively with some conventional hydro plants toward the end of this century. They also will compete with conventional pumping plants for the available low-cost off-peak energy. This could mean that aqueduct pumping will not receive full benefit of low-cost nuclear off-peak energy when it first becomes available, Shelton said.

The California Water Plan is a flexible pattern of water development which can be modified to fit changing conditions.

Changes in Capacity Reported to FPC

PLANT ADDITIONS DURING OCTOBER

State	Utility	Plant	Fuel	Capacity
Fla.	Florida Power Corp	Suwanee	S	75,000
Fla.	Florida Power & Light Co	X-FP-10—Navy (Leased)	S	34,500
Ind.	Indianapolis Power & Light Co	White River	S	100,000
Iowa	Lake Mills Municipal Light Dept	Lake Mills	IC	900
Iowa	Walnut Electric Light & Water Dept	Walnut	IC	488
Kan.	Attica Municipal Water & Light Plant	Attica	IC	560
Kan.	Sabetha Municipal Light & Water Dept	Sabetha	IC	1,500
Ky.	Tennessee Valley Authority	Shawnee	S	135,000
La.	Ruston Municipal Water & Light Dept	Ruston	IC	2,620
Maine	Bangor Hydro Electric Co	Milford	H	1,600
Mo.	Harrisonville Water & Light Dept	Harrisonville	IC	1,135
Neb.	U. S. District Engineers	Gavine Point	H	33,333
N. D.	U. S. Army Engineers	Garrison	H	80,000
N. J.	South River Board of Public Works	South River	IC	1,100
N. Y.	Herkimer Municipal Commission	Herkimer	IC	2,000
N. Y.	Long Island Lighting Co	E. F. Barrett	S	156,250
Okla.	Mangum Light & Power Dept	Mangum	IC	1,500
Pa.	Hatfield Municipal Electric Dept	Hatfield	IC	675
S. D.	Onida Municipal Electric Light Plant	Onida	IC	300
Wash.	U. S. Army Engineers	Chief Joseph	H	64,000
Wis.	Arcadia Municipal Light & Water Dept	Arcadia	IC	1,360
Wis.	Manitowoc Public Utilities	Manitowoc	S	22,000

RETIREMENTS

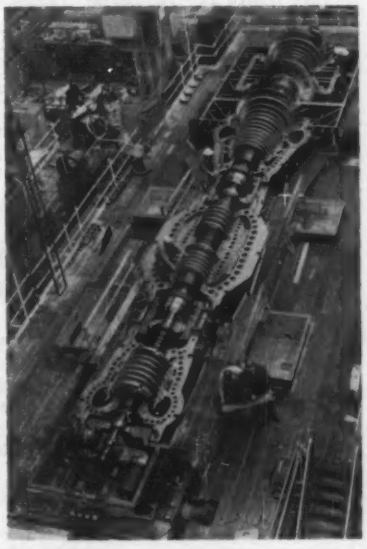
Ariz.	U. S. Indian IRR Service	Christmas	IC	1,200
Ill.	Salem Dept of Public Utilities	Salem	S	4,625
Ind.	Anderson Municipal Light & Power Dept	Anderson	S	10,000
Iowa	Walnut Electric Light & Water Dept	Walnut	IC	100
Kan.	Sabetha Municipal Light & Water Dept	Sabetha	IC	400
N. Y.	New York State Electric & Gas Corp	Indian Rapids	H	480
Wash.	Pacific Power & Light Co	Priest Rapids	H	2,100
Wis.	Arcadia Municipal Light & Water Dept	Arcadia	IC	150

U. S.	Hydro	Steam	IC	Total
Added	178,933	522,750	14,138	715,821
Retired	2,580	14,625	1,850	19,055
Adjustments Plus	.....	22,304	1,015	23,319
Adjustments Minus	.....	2,600	269	2,869
Net Change	176,353	527,829	13,034	717,216

H—Hydro, IC—Internal Combustion, S—Steam

United States Capacity as of November 1—Hydro, 25,467,765 kw; Steam, 91,508,165 kw; IC, 2,402,198 kw; Total, 119,378,128 kw.

PSE&G to Install Giant Steam Turbine



This automatic extraction steam turbine, reportedly the world's largest, will play a major part in a large industrial "swap" after it and its connected generator are installed in Public Service Electric & Gas Co's Linden (N. J.) plant.

The General Electric Co turbine, which was designed to handle 2,800,000 lb/hr, is said to have the largest steam flow of any turbine now in existence.

Steam, once it has already done efficient work in generating electric power, will be piped nearly a mile to the Esso Standard Oil Co's Bayway refinery. Here the steam will be used in the processing of petroleum products. In return, the refinery will pipe back residual oil to fuel the generating station's boilers.

Voltage Rise Spurred Cable Art,

DAVID WILLIAMS, Consolidated Edison Co of New York, New York, N. Y.

Voltage on cable for the transmission and distributation of electrical energy has increased from 120 to 330,000 v on overhead lines and from 120 to 230,000 v on underground lines in the United States over the past 75 years.

These lines transmit electrical energy from giant thermal and hydroelectrical generating stations to the most remote hamlet. The distance between generating station and ultimate user has stretched from the ½ mile of Thomas Alva Edison's original Pearl Street Station, New York, to more than 300 miles at the present time.

Changes in N. Y. Typical

And, in a few short years, electrical energy will be transmitted from commercial thermo-nuclear generating stations to urban, suburban, and rural users.

As voltages ascended, so also did the amount of cable used for their transmission. The increased use of cable on the system of Consolidated Edison Co of New York epitomizes the change all over the country, allowance being made for the varying special local situations.

From 1 Mile to 30,000 Miles

In the New York, the area originally served has mushroomed from 1 sq mile in lower Manhattan, with 59 customers, to 300 sq miles in Greater New York, and 300 sq miles in adjacent Westchester County with almost 3 million customers. The mileage of overhead lines—wire and cable—has grown from the 1 mile on Broadway in 1880 to 1930's 37,000 miles. There are 30,000 miles of overhead lines today, as they have been gradually replaced by underground lines.

Con Edison's overhead system has enlarged, in terms of copper consumption, from 1,000 lb for the original Broadway arc light installation of 1880 to 41 million lb installed as of December a year ago.

Underground lines have grown from 1881's 6 miles to today's 54,000 miles. The underground cable system has grown from 57,000 lb in 1881 to 269,000,000 lb as of

Historic Development of Electric

OVERHEAD LINES

1877			1st public exhibition of a street arc light in U. S: Newark, N. J.
1879	April	29	1st street arc light line in U. S: Public Square, Cleveland, Ohio
1879	Sept		1st commercial arc light line in U. S: San Francisco, Calif.
1880	Jan.	1	1st experimental incandescent light line: Menlo Park, N. J.
1880	Dec	18	1st permanent street arc light line in U. S: Broadway, N. Y. C.
1882	Sept	30	1st dc hydroelectric power: Appleton, Wis.
1883	Jan	19	1st dc commercial incandescent light line: Roselle, N. J.
1883	May	24	Brooklyn Bridge illuminated by 70 Weston arc lamps
1883	July	4	1st dc 3-wire overhead distribution system: Sunbury, Pa.
1886	March	16	1st 3,000-v 1ϕ experimental line in U. S: Great Barrington, Mass.
1886			1st 2,000-v ac transmission line: Cerchi Tivoli-Rome, Italy, 17 miles
1886	Nov	30	1st commercial ac system in U. S: Buffalo, N. Y.
1887			1st 10,000-v concentric Fowler-Waring cable, Deptford-London, 6½ miles
1887	June		1st dc hydroelectric line in U.S: Colton-San Bernandino, Calif. 8 miles
1889			1st 1,000-v 1ϕ 133-cycle line in New York City
1889	June	3	1st 4,000-v 1ϕ 125-cycle line in U. S: Oregon City-Portland, Ore., 14 miles
1891			1st 3,000-v ac line for industrial power in U. S: Telluride, Col., 3 miles
1891			1st 30,000-v 3ϕ line: Lauffen-Frankfort, Germany, 100 miles
1892	Nov.	28	1st 10,000-v 1ϕ line in U. S: San Antonio Canyon-Pomona, Calif., 14 miles
1893	March		1st 4–5 kv 3ϕ line, in U. S: Hartford, Conn.
1893	July	13	1st 11-kv transmission line in U. S: Folsom-Sacramento, Calif., 22 miles
1893			1st 12-kv polyphase line in U. S: Housatonic-Great Barrington, Mass., 7 miles
1895			1st 2,000-v 2ϕ 25-cycle line in U. S: Niagara Falls, N. Y.
1895			1st 2,400-v 2ϕ 60-cycle line in Brooklyn, N. Y.
1895			1st overhead trolley system in U. S: Nantasket Beach, Mass.
1896			1st 11-kv 3ϕ 25-cycle line in U. S: Niagara Falls-Buffalo, N. Y., 26 miles
1896			1st 15-kv transmission line in U. S: Ogden River-Salt Lake City, Utah, 36 miles
1898	March	21	1st 16.7-kv transmission line in U. S: Yuba-Marysville, Calif., 18 miles
1898			1st 30-kv 3ϕ line in U. S: Santa Ana Canyon-LosAngeles, Calif, 75 miles
1899	Sept	4	1st 40-kv line in U. S: Colgate Hydro-Sacramento, Calif., 61 miles
1901	April	7	1st 60-kv line in U. S:Colgate Hydro-Oakland, Calif., 142 miles
1906			1st 11-kv 1ϕ 25-cycle railroad electrification, Stamford, Conn-New York
1908			1st 100-kv transmission line in U. S: Las Plumas-Oakland, Calif, 155 miles
1908			1st 110-kv transmission line in U. S: Grand Rapids-Muskegon, Mich., 50 miles
1912			1st 140-kv transmission line in U. S: Cook Plant-Flint, Mich., 125 miles
1913			1st 150-kv transmission line in U. S: Big Creek-Los Angeles, Calif., 240 miles
1923	May	6	1st 220-kv transmission line: Big Creek-Los Angeles, Calif., 240 miles
1934			1st 287-kv transmission line in U. S: Hoover Dam-Los Angeles, Calif., 300 miles
1954			1st 330-kv transmission line in U. S: Portsmouth, Ohio

75-Year History Demonstrates

Transmission and Distribution Lines

UNDERGROUND LINES

1880	Nov	2	1st dc underground system demonstrated at Menlo Park, N. J.
1881	April	19	1st Edison 120-v 2-wire underground tubes laid in N. Y. C.
1883	Oct.	8	1st Edison 240-v 3-wire system in service: Brockton, Mass.
1885–87			1st oil-filled pipe type underground cable system developed by David Brooks, Philadelphia, Pa.
1885			1st hollow-core cable invented by J. J. C. Smith
1887	July		Edison 240-v 3-wire tube system installed in N. Y. C.
1890			1st 10-kv paper insulated conductors: Deptford, London, England (Ferranti)
1894			1st use of paper insulation on power cables in U. S.
1896			1st 2,400-v 2ϕ underground transmission in N. Y. C.
1897	Aug.		1st 4,500-v 3-conductor paper insulated cables purchased by Chicago Edison
1901			Paper insulation supersedes rubber on 6,600-v underground cables in N. Y. C.
1910	Dec.	10	1st 3x350-MCM Sector 6,600-v paper insulated cable purchased by New York Edison Co.
1913			1st 7,800-v underground cables installed in N. Y. C.
1913			1st 15,000-v underground cables installed in N. Y. C.
1915			1st 24,000-v underground cables installed in N. Y. C.
1920			1st Type "H" cable installed at Fall River, Mass., (25 kv)
1921			1st 33,000-v paper cable installed in Los Angeles, Calif.
1921			1st 3ϕ distribution system installed in N. Y. C.
1921–5			N. Y. C. changes from 6,600 to 11,000-v and from 7,800 to 13,200-v
1922			1st 35,000-v type "H" cable installed in Los Angeles, Calif.
1922			1st 120/208-v ac network system installed in N. Y. C.
1923	April	28	1st 45-kv cable: N. Y. C.-New Rochelle, N. Y., (11 miles)
1924			1st 45-kv Pirelli cables: N. Y. C.-New Rochelle, N. Y.
1924			1st 66-kv cable: Cleveland, Ohio
1925	June	9	1st 132-kv ¾-in. hollow-core Pirelli cable: Hell Gate-Dunwoodie (Service 8/9/27)
1925			Wood pulp paper replaces manila in paper-insulated cables
1929	Feb.	3	1st 132-kv ½-in. hollow-core Pirelli cable: Hell Gate-Dunwoodie
1929			1st 75-kv submarine cable: Deepwater, N. J.
1932	Oct.		1st 132-kv high-pressure, pipe type cable in U. S: Plymouth Meeting, Pa.
1939	May		1st 27-kv gas-filled cables ordered by Con Edison
1939	Nov.	16	1st 29-kv 3-conductor, oil-filled submarine cables ordered by Con Edison
1940			1st 110-kv high-pressure, gas-pipe type cable in U. S: Detroit, Mich.
1948	Feb	28	1st 132-kv high-pressure oil-pipe type cable in N. Y. C.
1948	Dec	21	1st 69-kv 3-conductor oil-filled cable ordered by Con Edison (Service 4/11/51)
1951	April	11	1st 69-kv high-pressure pipe type cable in service in N. Y. C.
1951	May	8	1st 132-kv high-pressure pipe type cable ordered for the Narrows, N. Y.
1952			1st 400-kv oil-filled cable installed in Sweden
1954	Jan	19	1st 15-kv silicone rubber generator cable ordered by Con Edison
1954			1st 265/460-v ac network off 69-kv pipe cable in N. Y. C.
1954			1st 230-kv high-pressure pipe type cable Garrison Dam, N. D.
1954			1st 301-kv oil-filled cable installed in Canada.

December 1955, latest figure.

On that date, the total copper in lines and cable on the Con Edison overhead and underground system was 310,000,000 lb, and technological and system changes have required the procurement of more than 531,000,000 lb of copper in the various types and sizes of cables used on such a vast and complex system.

How Copper Use Grew

It is historically significant that it took 42 years to accumulate the first 100,000,000 lb of copper, 6 years the second, 4 years the third, 12 years the fourth (this period covering the depressed 1930's), and 10 years the fifth (World War II slowing the rate).

Weighted average prices of copper prevailing during those periods were:

1880 to 1922 . . .	16¢ per lb
1923 to 1928 . . .	14¢ per lb
1929 to 1932 . . .	12¢ per lb
1933 to 1944 . . .	10¢ per lb
1945 to 1954 . . .	23¢ per lb

In 1956 copper prices reached 46¢ per lb before leveling off at 40¢ per lb. This rise has given considerable impetus to these developments:

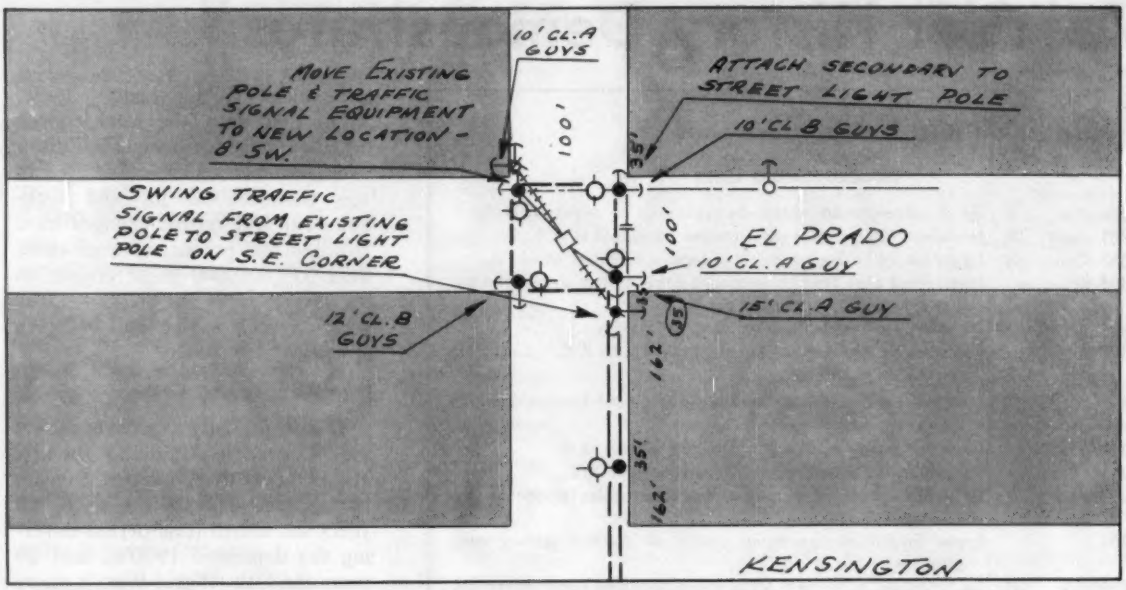
1. Operation at higher voltages, reducing the amount of copper required.

2. Substitution of less expensive aluminum for copper wherever it is feasible.

First Al Cable in 1951

Con Edison has been a leader in adopting higher voltages for both underground and overhead lines. It first purchased aluminum cable for such use in November 1951. Among high-voltage cable developments on the system are the replacement of lead sheath by aluminum, use of silicone rubber for generator leads, substitution of polyethylene for paper insulation, and installation of high internal gas pressure cable in place of high-pressure oil-filled pipe-type cable.

In these ways, Con Edison continues the pioneering spirit evidenced 75 years ago by Edison when he designed the first commercially successful underground cable.



Plans by Tampa Electric Are Basis of Program under which . . .

Tampa Modernizes Street Lighting

J. A. BANTON, Illuminating Eng, Tampa Electric Co, Tampa, Fla.

When Tampa, Fla., decided to embark on one of the nation's most ambitious programs of street lighting modernization, Tampa Electric Co was quick to grasp an opportunity. It lost no time in offering assistance in planning and executing the program.

The result was much improved relations with city officials. The company now finds them more cooperative in matters, such as zoning changes and placement

BEFORE—Tampa's Bayshore Boulevard lost its daytime beauty in the dark of night and was scene of many accidents

of poles and substations, with mutual profit for both.

Six years ago Tampa's street lighting was highly inadequate. There were no mercury vapor or fluorescent street lights in use. Many of the incandescent units were 1,000-lumen lamps in old radial wave reflectors. Today there are between 20 and 25 miles of mercury vapor street lights. Additional lights already authorized will bring this total to 50 miles within a few months, and the end is not in sight.

Tampa is moving steadily forward with its street lighting program despite the handicaps imposed by its phenomenal growth. In the past six years the population has doubled from 125,000 to 250,000.

The relighting project got under way in 1950 with the installation of a series of mercury vapor luminaires which replaced five-light clusters on Franklin Street, Tampa's main street. The project has since been broadened to include main business streets and primary traffic arteries. But the best part of the plan lies ahead. The project is to be extended to secondary business and traffic streets. In addition a great number of self-contained multiple units will be installed in residential areas.

The company has prepared (and keeps up to date) maps for city officials that show at a glance all business and traffic arteries and the portions of each now lighted with mercury vapor units and the streets for which such installations have been authorized. Company officials hold frequent conferences with city traffic planners to decide the priority of streets. Then the company designs lighting systems for them and submits them to the city for approval.

Although there were a number of reasons why Tampa decided on the street lighting program, safety was a major one. As an example of the effectiveness of street lighting in reducing traffic accidents, here is a report on results credited to a 280-unit mercury vapor installation on Bayshore Boulevard. Comparing the first nine months of 1954 before with the first nine months of 1955 after the relighting job, night accidents decreased from 21 to 14, accidents with injuries from 7 to 4, and fatalities from 3 to 0.

In addition to the 20,000-lumen mercury vapor luminaires installed along Bayshore Boulevard, the city has made these installations:

1. Franklin Street—Five-light clusters have been replaced with 11,000-lumen mercury vapor units. Luminaires are mounted 28.5 ft above the pavement, have an overhang of 4 ft, and are spaced oppositely about 105 ft apart. Maintained illumination has been boosted to about 1 ft-c. Luminaires are on steel poles with underground wiring.

2. Other downtown streets—Practically the same lighting.

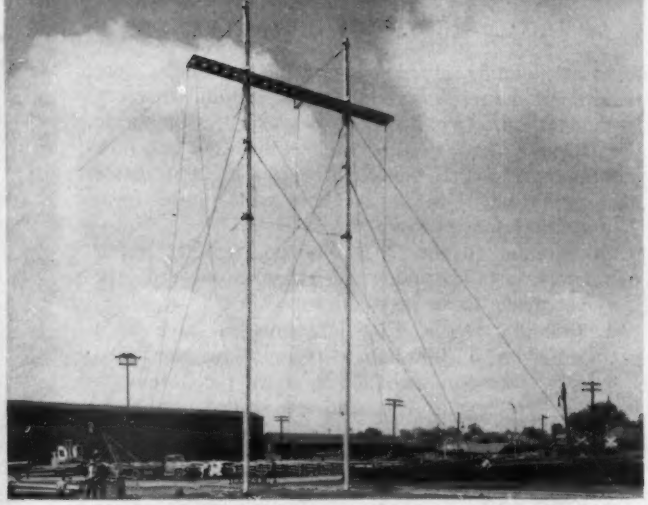
3. Heavy and medium traffic areas—Illuminated by 20,000-lumen units installed in staggered or one-side-only patterns at intervals between 150 and 175 ft.

4. Residential areas—Filament luminaires have been installed both on series and multiple circuits. In addition, hundreds of 200-w units with self-contained photoelectric controls have been installed.

In all cases installations have been installed, financed, operated, and maintained by Tampa Electric which sells street lighting service to the city.

Rates are based on the size of bulb used, whether poles are metal or wood, whether wiring is underground or overhead, and other considerations. They are based on all-night burning or approximately 4,000 hr per yr. A state regulatory body has approved the rates.

AFTER—Accident rate decreased 33%. Accidents with injuries went down 42%. Fatalities were entirely eliminated



TUBULAR STEEL POLES are the basis of new transmission line structure comparable in cost with wood pole construction

80-FT STRUCTURE can be erected, after assembly in a single piece, when a crane with a 55-ft boom can be so employed

Tubular Steel Poles Economical

TRANSMISSION Design

New design enables Georgia Power to secure advantages of steel at a cost only 12.5% over cost of wood structures

E. A. ROBERTS, Senior Engineer, Engineering Department, Georgia Power Co, Atlanta, Ga.

The advantages of steel towers at an initial cost per mile only 12.5% above the cost of wood are provided by a new type of steel structure designed and tested by Georgia Power Co. This H-frame is a beam-type crossarm attached by flexible shackles to two tubular-steel poles resting on concrete bases. Stability depends on 12 guys.

The 230-kv design supports three 1,033,500-cir mil 54/7 ACSR and two ⅜-in. 7-strand high-strength overhead ground wires under medium loading. The structure withstands any combination of two broken conductors because of reduced tension due to swing of insulators and crossarm. For 1,000-ft ruling span the maximum tension in the conductor is 12,500 lb and in the overhead ground wire, 4,765 lb. A span of 2,000 ft was used in calculating maximum transverse wind and vertical weight. Design loads were increased over actual loads, as required by NESC.

Low installed cost results from the use of guys, simple foundations, flexible crossarm attachments, and sectional poles.

Guys are an efficient way of supporting load. Their installation can be made at nominal cost for labor and material when modern hole diggers and expanding type anchors are used. Attachments have been placed to minimize bending moments in the steel poles. This permits the use of light-weight tubes. Without uplift and with only little transverse load, foundations support loads primarily vertical. Thus the bases were reduced in size and weight to permit use of precast concrete. Setting, leveling, and aligning is simplified by the structure's flexibility.

Attachments contribute to low cost by reducing erection time. Crossarms are easily attached to poles on the ground or standing. When assembled on the ground the structure is erected without the danger of overstressing inherent in more rigid ones. Leveling, aligning, and plumbing are not critical. In event of a broken conductor, the flexible attachment helps reduce line tension and loads on the assembly.

Simplicity and standardization of parts contribute to lower costs. Only four standard pole sections are required to obtain nine different structure heights. To obtain the same heights with wood poles, nine lengths would be needed, these probably of several classes. Structures for a complete line can be assembled from the 14 items in Table I.

The assembly weighs about half as much as a comparable wood pole structure or steel tower. This means less freight, handling, erection, and maintenance expenses, as well as lower material costs.

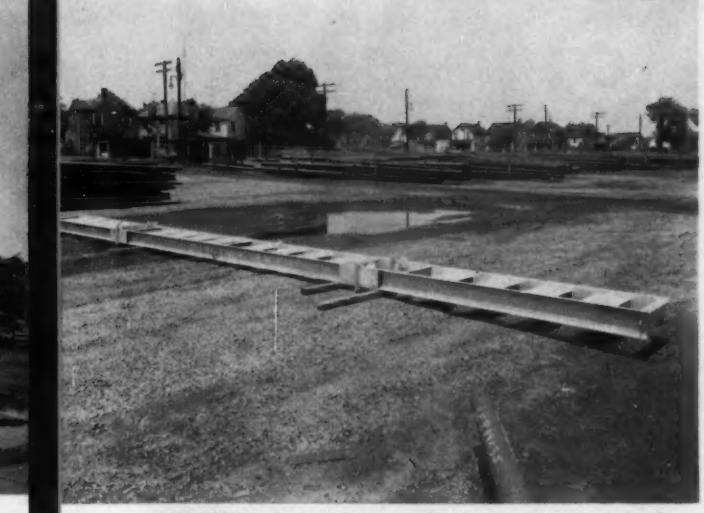
Each pole consists of two tapered steel tubes. These are bolt-assembled in the field by means of flanges welded to the larger ends. With only four standard lengths—30, 35, 45, and 50 ft—the structure height can be varied from 60 to 100 ft in 5-ft increments.

Small ends of all tubes have the same diameter. Either a steel base or an overhead ground wire fitting is attached in the field. The larger ends of different length tubes have their own diameters, but variations are absorbed by the width of the flanges, all of which have the same bolt circle. Lugs welded to the tubes standard tower-step bolts for climbing.

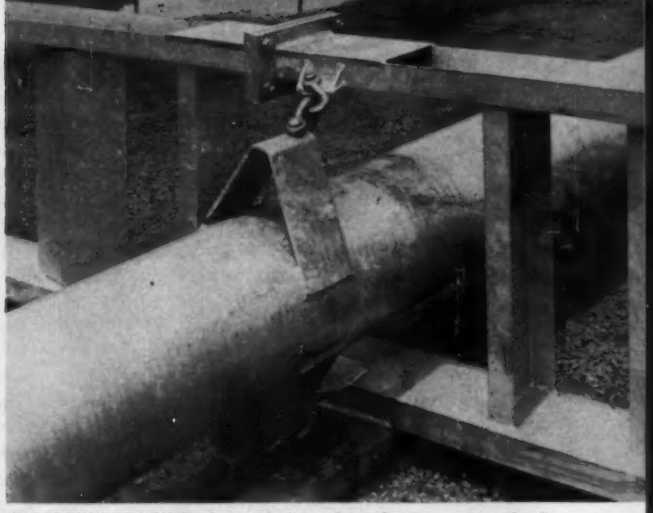
The tapered tubes were fabricated from trapezoidal sheets of 7-gauge low-carbon steel. They were formed

Adapted from a paper presented at a Southeastern Electric Exchange Engineering & Operation Section meeting.

With all wires intact and maximum transverse load



CROSSARM designed for steel-pole structure is of the beam type, reinforced by plates welded between 9-in. channels



CROSSARM BRACKET was redesigned to obtain greater flexibility. Two 9-in. 13.4-lb channels make up the crossarm

For Supporting 230-Kv H-Frames

approximately and machine-welded longitudinally. The tubes were then cold rolled to true cross-section on mandrel. This process materially increases the yield point to a minimum of 48,000 psi. Fabrication is followed by hot-dip galvanizing inside and out.

Because maximum capacity of the machines is 40 ft, longer tubes are spliced in the factory with a split joint.

The 40-ft crossarm is two 9-in., 13.4-lb channels spaced 25 in. apart with $\frac{3}{16}$-in. stiffener plates welded between. The stiffener plates are bent to provide torsional strength for the arm. At each conductor location a 4 x 7 x $\frac{3}{8}$-in. angle is welded between the channels, and a hole in the bottom edge of the angle receives the suspension hook of the insulator string.

Suspension plates for anchor shackles are welded to both channels at locations where they attach to the poles. The channels are boxed for a short distance on each side of the plate to add strength. For the same reason a 8-in., 11.5-lb channel spacer is welded between the 9-in. channels on each side of the opening for the pole. The opening in the arm passes over flanged joints in the pole.

This one-piece crossarm has replaced a more costly, three-part one that bolts together in the field. It was thought originally that the three pieces would be easier to handle, but the unit arm has proved as satisfactory.

A high degree of flexibility in the attachment between crossarm and pole is integral to the structure's design and was obtained by using two straight high-strength anchor shackles at each bracket. These permit full swing of the arm under maximum load without binding.

In the initial design the crossarm bracket welded to the pole was V-shaped, the hole being in the base of the V. It was changed to a Y-shape in later design to gain flexibility.

Each pole's foundation is a precast concrete base. Because there is no uplift, the pole is not bolted. Lateral movement is prevented by a rod cast into the base. This rod protrudes through a hole in the bearing plate attached to the bottom of the pole.

Precast bases are set in holes bored to the required depth with a power-driven earth auger. Spacing, leveling, and aligning of the bases are not critical operations as the structure is flexible.

Table I—These Items Are Required for Steel Pole Lines

30-ft pole sections	Bolts for pole flanges
35-ft pole sections	Guy Wire
45-ft pole sections	Guy clamps
50-ft pole sections	Anchors
Crossarms	Anchor rods
Steel pole bases	Anchor shackles
Precast concrete bases	Swinging brackets

Table II—Tubular Steel H-Frames Cost Little More Than Wood

	Guyed Tubular St. H-Frame	X-Braced Wood Pole Str.
Surveys	350	350
Clear R/W (150′ wide, 50% woods)	1,400	1,400
Tubular structures ($16/ft)	7,568	.....
Wood pole structures	.....	3,920
Guying material	1,000	345
Insulators	768	1,015
Conductor (1,033,500 cir mil, 54/7 ACSR)	7,695	7,695
Overhead ground wire (3/8 in., 7-strand stl.)	800	800
Conductor clamps and fittings	290	558
OH ground wire clamps and fittings	44	119
Precast concrete foundations	200	.....
Counterpoise	46	173
Total construction labor	3,400	4,010
Transportation and meals	2,040	2,406
Sub-total	25,601	22,791
Engr'g and overhead 12%	3,072	2,734
Total cost per mile	28,673	25,525

With all wires intact and maximum transverse load on the structure, the total vertical load on each base is 19,240 lb. Multiplying this by 1.27 gives a design load of 24,435 lb. When a conductor is broken, the vertical load becomes 27,625 lb. Dead weight, including structure and attachments under zero ice and wind loads is 9,276 lb. This does not require a broad base to keep unit soil pressure wthin conservative limits. But notably poor soil conditions could require bases of larger cross-sections.

The H-frame structure depends on guys for stability. Longitudinal loads are carried by guys attached just below the crossarm; transverse loads by those 10 ft below to provide clearance for maximum swing of insulators. Transverse guys are rotated slightly from the corresponding axis of the structure, so that inside guys miss the pole on the opposite side of the H-frame. J-hooks for guy attachments are welded to the steel poles. Guys are wrapped one turn around and secured with standard clamps.

Soundness of the structure design was confirmed by studies under loads equal to and sometimes greater than design maxima. Three loading tests were made on an 80-ft structure; one for maximum transverse, another for broken overhead ground wire, and the third for broken conductor.

Loadings and deflections are shown in accompanying illustrations. Departures were determined by means of a transit which projected the points to the ground where distances were measured. Practically all deflection recorded as "set" resulted from creep in the anchors and guys.

Although impact effect of a broken conductor was not simulated, it is felt that the structure would absorb this load. The insulator swing and crossarm deflection would reduce ultimate tension in the conductor, thus acting as a cushion. Maximum tension of a broken conductor would be much less than the 10,000-lb test.

A rubber-tired crane was used in erecting the test structure. This was accomplished in 29 min by ten men, the structure having been assembled on the ground with guys attached. Anchors and foundations were in place.

For lightning protection, structure dimensions are adequate to utilize the full impulse insulation level of sixteen 5¾ x 10-in. suspension units while loaded with 4-lb wind. Shielding angle is 24 deg with insulator strings hanging vertical and 30 deg with 4-lb wind. The 12 guys, steel poles, and 1½-in. x 300-ft counterpoise strip provide a low-impedance ground. Probable interruptions per 100 miles per year is 0.67 in an area with an isokeraunic level of 60.

Tapered steel poles are adapted easily to conventional three-pole angle structures. Single-string suspension is used for angles up to 30-35 deg. Above this a two-string, V-type suspension or a full strain is required. For three-pole construction the tubes are the same as for tangent structures except that crossarm brackets are omitted and J-hooks are at different positions.

Swinging brackets for three-pole steel structures are the same as for wood, but are attached with bands.

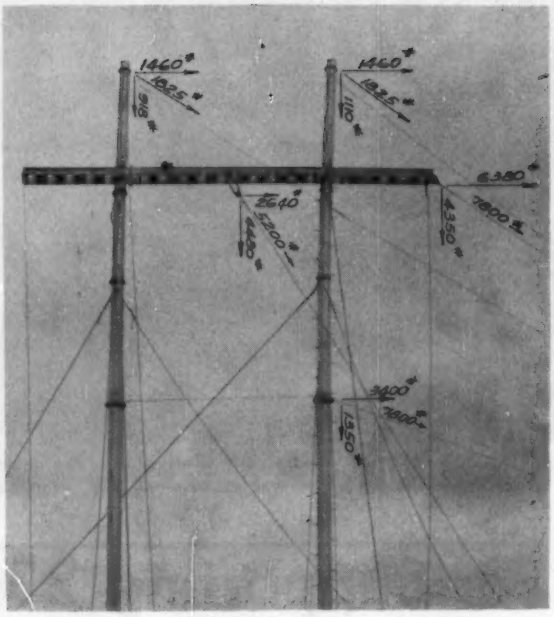
Cost of a typical mile of 230-kv guyed tubular-steel H-frames is about 12.5% greater than that for a mile of wood H-frames. The estimated costs in Table II are conservative and are based on an 18-mile profile containing 0.9 angles and 3.4 crossings per mile. A typical mile of wood H-frames has 8.4 spans, and poles are predominantly 60 to 65 ft. Steel H-frames have 4.5 spans, and structure height averages 80 ft. Cost per ft of steel structure height is almost constant at $16 per ft up to 100-ft height.

In cost estimates the wood structure was considered as having a heavy crossarm and longitudinal guys every mile to insure against loss of line from a broken conductor. The same risk with steel-tube H-frames would require only longitudinal guys every mile.

Guyed tubular steel structures can be used to advantage in acquiring right-of-way. More height is available, and they require about 50% fewer spans and structures. They require less maintenance also.

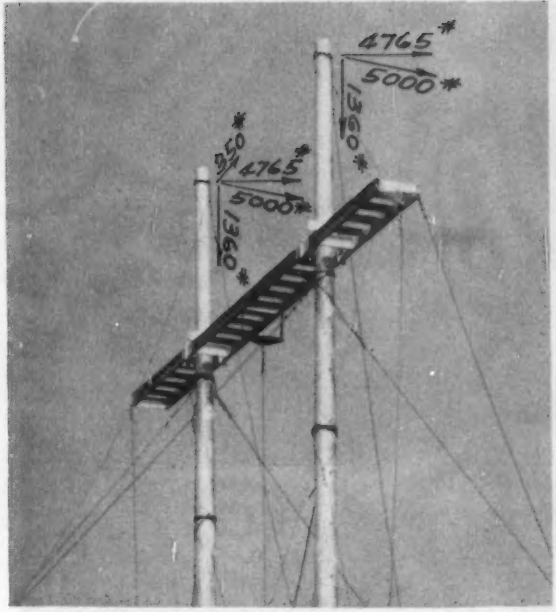
Tubular-pole strength can be increased by fabricating tubes from heavier gauge metal. Tube diameter and wall thickness, however, should not be reduced below that of the design, even though structure loads may be substantially lower. Reducing heights would increase the cost per mile of line much more than the savings in material costs.

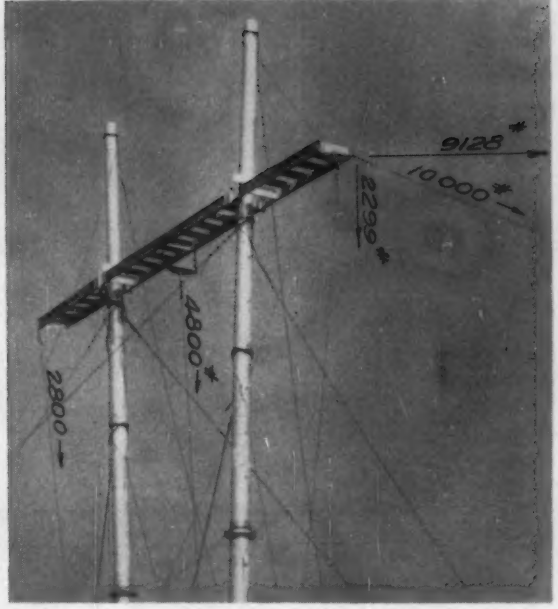
Georgia Power has ordered 12 tubular-steel structures. Two, being installed at a river crossing to carry two 110-kv circuits have their crossarms altered for attachments for six conductors in strain, instead of three in suspension. Eight tangent and two three-pole structures will soon be installed for a 230-kv line.



Maximum Transverse Load Test

Pole at	Deflection (Under load) In.	Set (Load removed) In.
Top	31–1/4	0
Crossarm	36	0
Flange joint	13–1/8	0



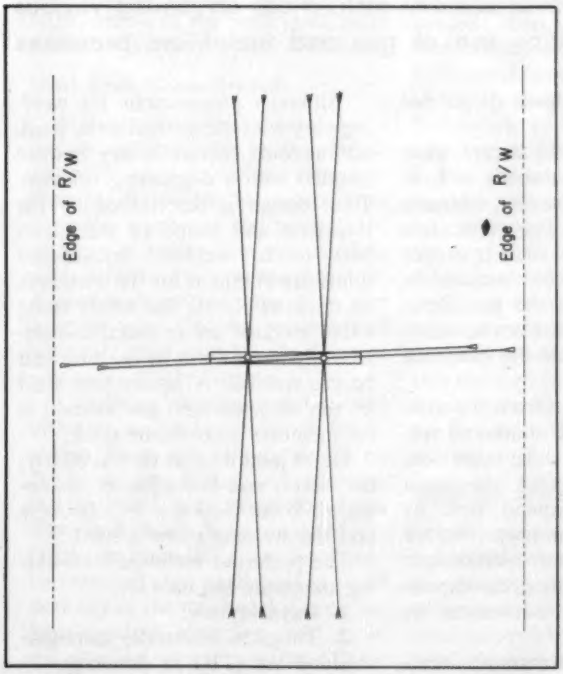


Broken Overhead Ground Wire

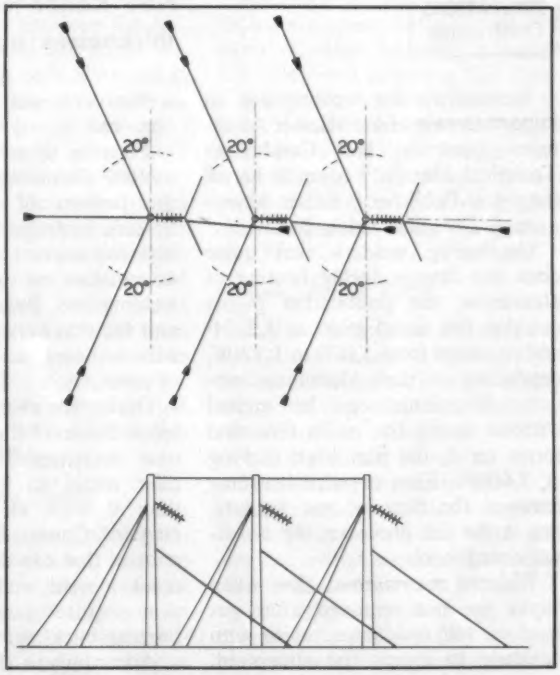
Pole at	Deflection (Under load) In.	Set (Load removed) In.	Bend in Pole In.
Top	23–1/4	3–5/8	Reference point
Crossarm	14	2–7/8	About 1/4

Broken Conductor Test

	Deflection (Under load) In.	Set (Load removed) In.	Bend in Pole In.
Pole Top	23–1/8	5–1/4	Reference point
Pole at crossarm	17	4	1/2
Pole at flange joint	8–1/2	2–3/8	5/8
End of crossarm	47–1/8	10–1/4	.....

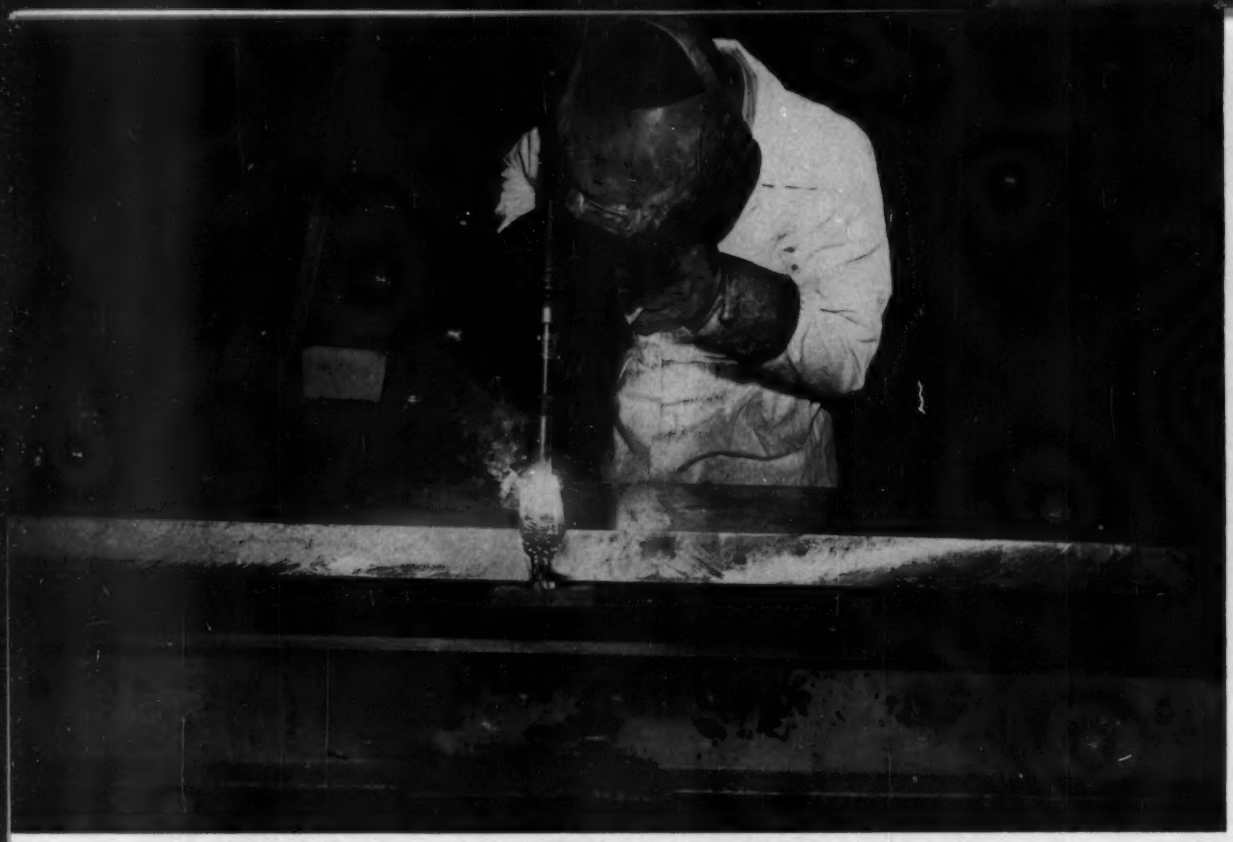


STABILITY for the H-frame structure is the result of a system of guys. J-hooks for guy attachment are welded to pole



GUYING PLAN for a three-pole angle structure shows each pole guyed for stability without the conductors in place

Other methods adaptable to joining aluminum and its alloys are



How to Weld Aluminum Bus

SUBSTATIONS
Construction

New Kaiser manual contains instructions on joining various thicknesses and on use of gas and metal arc processes

Instructions for welding are an important part of the "Kaiser Aluminum Electrical Bus Conductors Technical Manual," soon to be off the press. Publisher is Kaiser Aluminum & Chemical Sales, Inc.

Cautioning welders that color does not change during heating of aluminum, the publication points out that this metal melts at 1,220F and its alloys from 1,020 to 1,220F, depending on their aluminum content. Aluminum can be melted without fusing the oxide film that forms on it, the film itself melting at 3,600F. Flux or wire brushing removes the film for gas welding, but in the arc processes the arc itself does the job.

Welders are warned that when fluxes are not removed after gas welding, salt residues combine with moisture to attack the aluminum. Immersion in a sulphuric acid solution cleans small sections, and hot water or steam cleans large bus sections.

Porosity in a weld occurs when molten aluminum absorbs and, in the process of freezing, releases nascent hydrogen. The publication lists the sources of such hydrogen as moisture on the bus surfaces or welding rod, fluxes, the gas flame, and the atmosphere. Care to eliminate moisture reduces the incidence of porosity.

During the change from the molten to the solid state, aluminum volume decreases 7%. It takes less filler metal to expand aluminum than it does to expand steel or copper. Contraction may produce stresses that can distort members or crack a weld, and its great expansion requires large allowances to prevent buckling.

According to the manual, inert-gas-shielded arc welds are less prone to cracking than gas welds.

Although preparations for welding vary with the method to be used, all methods require a dry surface cleaned with a degreasing solution. Joint design is determined by the thickness and shape of the members to be welded. Square-butt joints are common for flat members as thick as $\frac{3}{16}$ in., the welds being either metallic-arc or metallic-inert-gas. Members up to ¼ in. thick can be gas welded. A square-butt weld by the tungsten-inert-gas method is for members up to ⅛ in. thick.

Other joint designs vary similarly, the bevels and bevel angles changing with the thickness of members and the welding method used.

The preferred methods for welding aluminum bus bars are:

1. Oxyacetylene.

2. Tungsten electrode, inert-gas-shielded arc (TIG in drawing).

3. Consumable electrode inert-gas-shielded arc (MIG in drawing).

Other methods adaptable to joining aluminum and its alloys are oxyhydrogen, carbon arc, atomic hydrogen arc, flash welding, and pressure welding.

Gas Welding Common

Gas welding is commonly used when only a few welds are to be made, and oxyacetylene, normally used for welding other metals, is the most commonly used gas. Oxyhydrogen is the second most widely used gas. Gas welding, however, produces an adverse effect on the strength of the base metal greater than that of any other method because of its high heat input and relatively slow welding rate.

Chloride powder, mixed with alcohol or water, form a paste flux for gas welding. Containers for this flux should be glass, ceramic, or aluminum as steel or brass contaminates it. Flux is applied to the base metal and the filler rod.

Gas welding is recommended only for flat or horizontal welding. In gas welding, the flame is kept on the rod and edges evenly and on the centerline of the weld to assure uniform heating of the two edges. To start the weld, the flame is given a circular motion with an ever-increasing radius to heat and melt the adjacent metal. At the end, a slight excess of the weld material is added to compensate for shrinkage.

Heat Zone Concentrated

Metallic arc welding produces a highly concentrated heat zone so that arc welds have less distortion than gas welds. A flux-coated consumable electrode is used. Arc welding is faster than gas welding and requires more experience. Dc is used with reverse polarity to give a stable arc. Current settings and electrode sizes vary for the different aluminum thicknesses.

Usually, preheating is not needed although a slight preheat, to 250F, makes metal-arc-welding easier on thick sections and improves penetration. Such preheating cuts down distortion and reduces unsoundness in the the weld. Flux coating should be removed after each pass to avoid porosity of the weld, and it is necessary to clean after the weld as in gas welding.

The inert-gas-shielded, tungsten-arc process, widely used for welding aluminum bus, can be done at high speed. The arc is established between the non-consumable tungsten electrode and the section to be welded. Inert gas envelops the arc. In this method, the arc melts the base metal, and a bare filler rod is added by hand. No flux is used. Preheating is desirable for thicknesses greater than ½ in.

The arc is established by touching the tungsten electrode to the bus and then withdrawing it. The arc is given a circular motion until the base metal liquifies and the weld puddle is established. Filler rod is added as required. The weld must be wire brushed between passes to remove surface dirt which accumulated from the previous pass. As no flux is used, the finished welds do not require cleaning.

Increases Welding Speed

The consumable electrode, inert-gas-shielded metal-arc welding process combines the advantages of tungsten arc welding with increased welding speed. Any welding position can be used. The process can be either manual or automatic as the heat is concentrated in a small area and high current densities can be used for overhead and vertical welding.

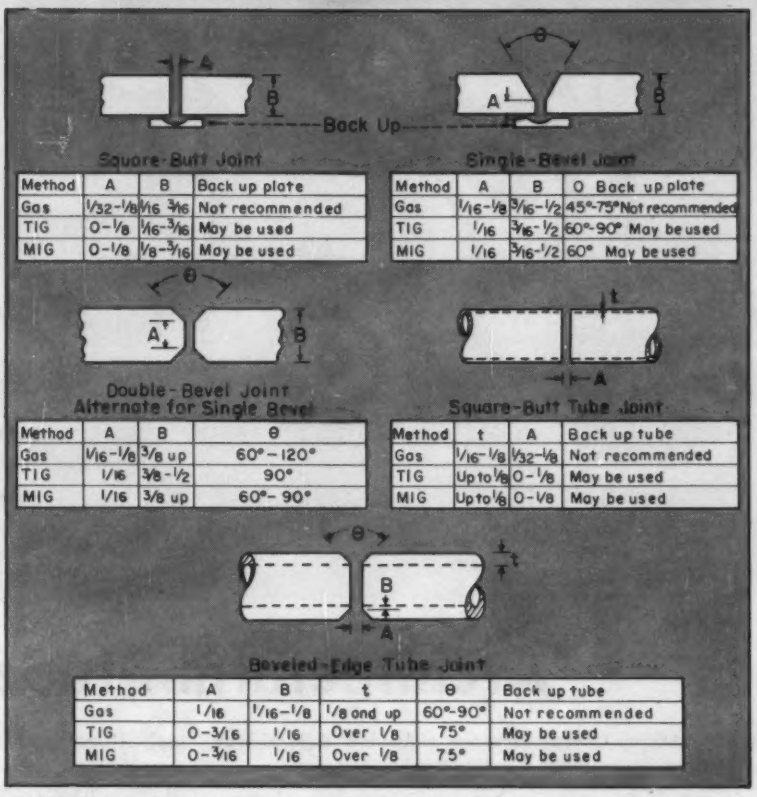
Although manual welding techniques are somewhat different than those of other methods, a welder can be trained in only a few days.

Aluminum back-up bars of the same composition as the parent metal are often used. Usually they are left intact when welding is completed although precautions must be taken to prevent collection of moisture between them and the bus.

Helium, Argon Cited

Helium, argon, or a mixture of the two are suitable shielding gases. On heavy bus bars, the gases usually are mixed to combine the hotter arc characteristics of helium with the stabilizing effects of argon.

For welding copper to aluminum, special processes are required. When these metals are welded directly, a brittle inter-metallic copper-aluminum compound is formed. To avoid this, the copper is coated with a material metallurgically compatible with both copper and aluminum, such as silver solders. Either the tungsten-inert-gas, or the metal-inert-gas process may be used.



Method	A	B	Back up plate
Gas	1/32-1/8	1/16-3/16	Not recommended
TIG	0-1/8	1/16-3/16	May be used
MIG	0-1/8	1/8-3/16	May be used

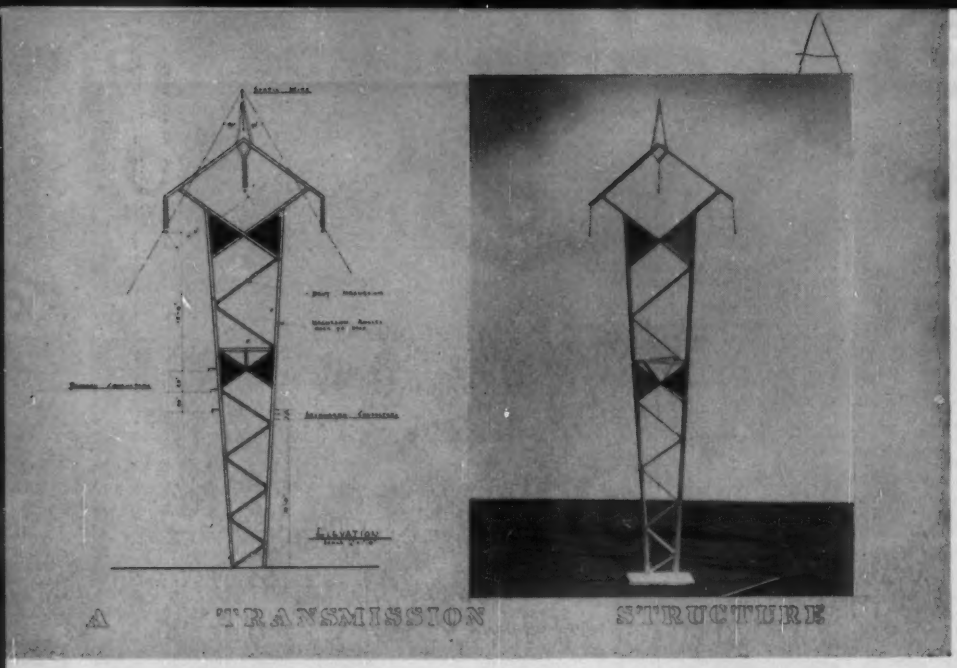
Method	A	B	θ	Back up plate
Gas	1/16-1/8	3/16-1/2	45°-75°	Not recommended
TIG	1/16	3/16-1/2	60°-90°	May be used
MIG	1/16	3/16-1/2	60°	May be used

Method	A	B	θ
Gas	1/16-1/8	3/8 up	60°-120°
TIG	1/16	3/8-1/2	90°
MIG	1/16	3/8 up	60°-90°

Method	t	A	Back up tube
Gas	1/16-1/8	1/32-1/8	Not recommended
TIG	Up to 1/8	0-1/8	May be used
MIG	Up to 1/8	0-1/8	May be used

Method	A	B	t	θ	Back up tube
Gas	1/16	1/16-1/8	1/8 and up	60°-90°	Not recommended
TIG	0-3/16	1/16	Over 1/8	75°	May be used
MIG	0-3/16	1/16	Over 1/8	75°	May be used

DESIGNS AND PROCESSES PERTINENT TO THE WELDING OF BUTT JOINTS



MAGNESIUM ANGLES and cross members of this design are given added stiffness by steel tension members

Architectural Students Propose

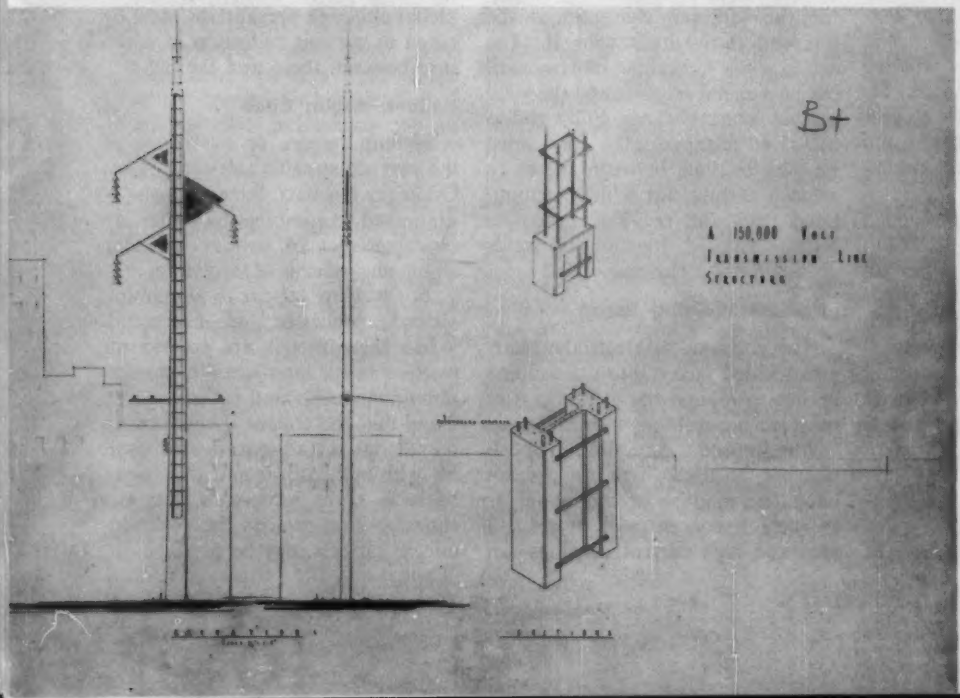
WADE LARKIN, General Supervisor of Lands & Right of Way, Northern States Power Co, Minneapolis, Minn.

Architectural students designed some highly unconventional transmission structures which an electric company is eyeing with interest.

It all started when a University of Minnesota professor registered a friendly complaint against the aesthetic appearance of Northern States Power Co's transmission line structures. Conferences between NSP and the university resulted in a study problem of 150-kv structure design for senior students of the School of Architecture.

NSP outlined the basic provisions, and the university modified them to provide a suitable problem. It was agreed that the structure should meet basic transmission shielding requirements and that distribution primaries and secondaries would be carried. Work was limited to 8 hr of actual study and design presentation.

One NSP objective was a structure having a base not more than 4 ft square. But the university did not include this specification. Some designs were impractical, but four local practicing architects judged that the results were above average for a student project. Willard J. Lee, transmission designer, represented



PRESTRESSED CONCRETE in a general I-beam section gives this design maximum stiffness with minimum material

B
CONSTRUCTION POLE FOR N. S. P. CO.
NOTE: STAINLESS STEEL POLES INDIVIDUALLY FABRICATED IN SIX SIZES, AND COMBINED AS NEEDED BY N S P CO

CIRCULAR SECTIONS were provided with appropriate pole heads clustered together to produce this design

Future Transmission Structures

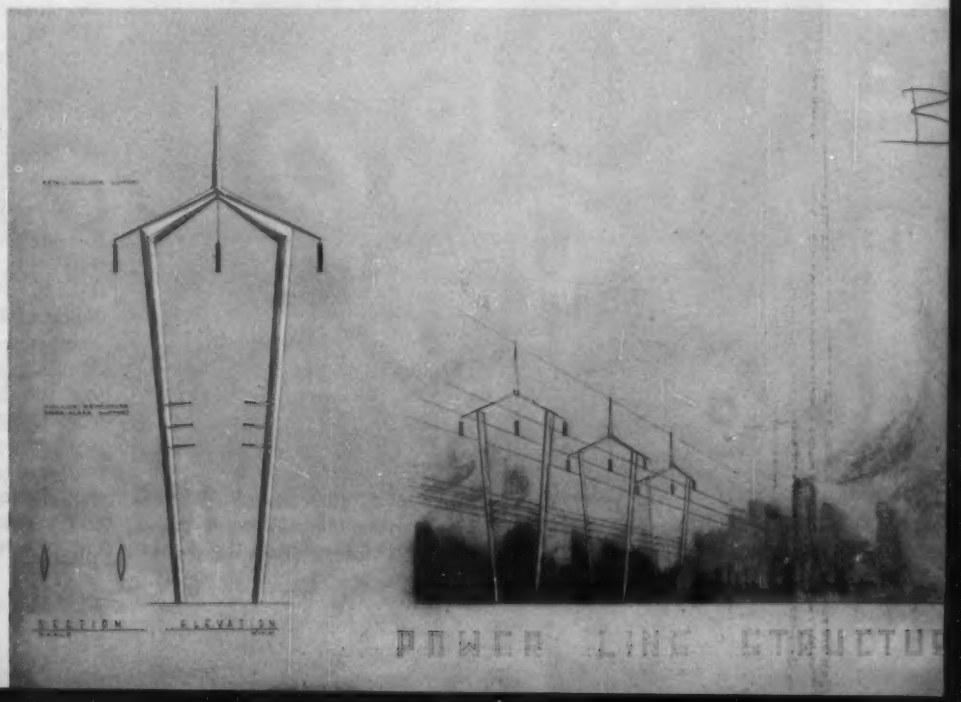
Northern States Power on the panel of judges.

Of special interest to NSP was a structure (bottom left) using pre-stressed concrete in a general I-beam section to give maximum stiffness with minimum material. The stirrup reinforcement serves a dual purpose of providing shear resistance and rungs for climbing.

Another structure (top right) employs circular sections with appropriate pole heads clustered together to provide overhead supports. It appears to have considerable possibilities because it solves problems of design standardization and warehousing.

The single "A" grade was awarded to an eye-pleasing structure (top left) of fairly conventional form. It employs minimum section compression members incorporated with high-strength wires in a tensioning scheme for developing considerable stiffness for the over-all structure. Colored panels can be added where local conditions suggest a decorative motif. Another design (bottom right) uses formed plastics to construct a rigid frame of a shape and size that support conductors and shield wires only.

The university and NSP were pleased with the designs, and the project has spurred NSP's design personnel to delve more deeply into transmission designs under consideration. Meanwhile, the power company is continuing its evaluation of the students' ideas.



FORMED PLASTICS of this design provide a rigid frame capable of supporting the conductors and shield wire

Concrete Replaces Wood H-Frames

TRANSMISSION
Design

Florida Power finds prestressed structures last longer and are cheaper to maintain although initial cost is 60% higher

W. L. PILSBURY, Supt of Transmission, Construction, and Maintenance,

C. B. BENHAM, Chief Transmission Engineer, Florida Power Corp, S. Petersburg, Fla.

The first prestressed concrete H-frames for a 110-kv transmission line in the United States were installed recently by Florida Power Corp at a cost only 60% greater than a line of Southern pine H-frames. But the prestressed concrete's longer life and smaller maintenance requirements are expected to lower annual charges. The new H-frames also have greater resistance to fire and more predictable performance.

Prompting Florida Power's search for a substitute for wood poles was the dwindling supply of Southern pine in long lengths. This timber is now in demand for pulpwood and saw logs. Florida's subtropical climate is conducive to the decay of Western red cedar and Douglas fir.

Reinforced concrete poles have been used for transmission lines in Algeria, Italy, Austria, Germany, and Norway for many years, but prestressed concrete poles, apparently, were first installed in Algeria in 1941 during a steel shortage. Prestressed concrete structures need only a third of the steel used in reinforcing concrete and, consequently, are considerably lighter.

Prestressing creates compression in the pole section that resists tension under loads. The structure's tensile strength is increased with the amount of prestressing. A rectangular concrete beam of this kind develops stresses in bending exceeding 4,200 psi without cracking. Reinforced concrete can develop stresses of only 700 to 900 psi. Thus prestressing gives a strength four to six times that of reinforced concrete.

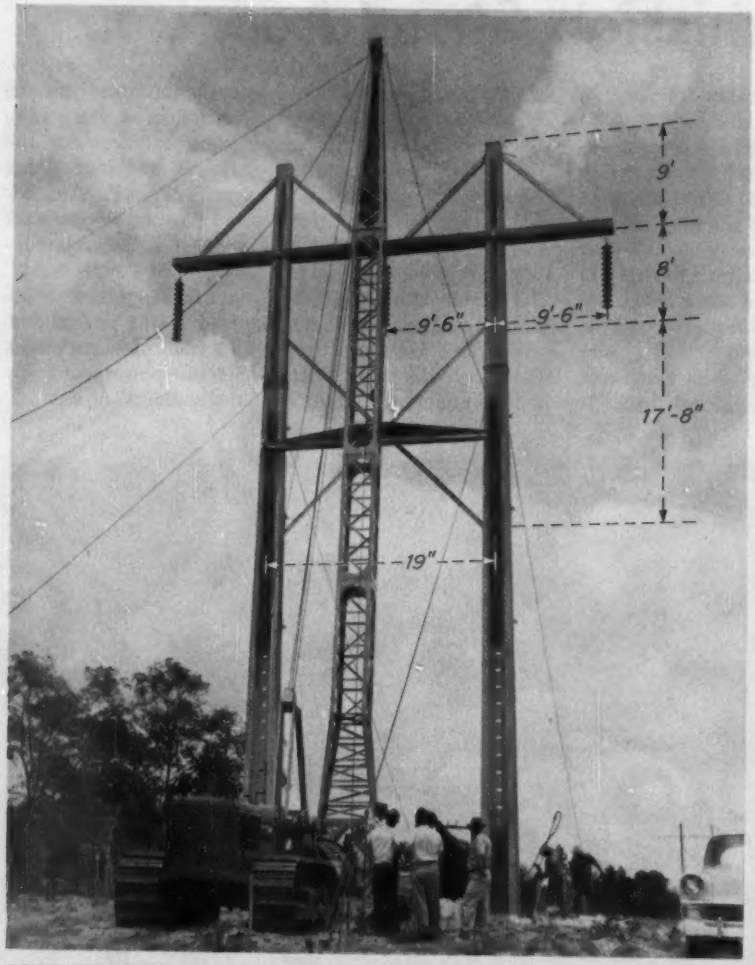
Capillary cracks caused by overloads in prestressed concrete close up and become virtually watertight when the overload is removed.

Florida Power's first experimental prestressed concrete structure, consisting of 75-ft poles, a 39-ft crossarm, V-braces, and crossbraces, was intended to withstand a 23,300-lb transverse load just above the crossarm. Tested to destruction, it successfully sustained 21,900 lb. At this stress, deflection at the top was 17⅜ in.; uplift was $\frac{3}{16}$ in.

When the load was increased beyond 21,900 lb, a defective crossbrace buckled, resulting in the dropping of the load by increased deflection. Poles and crossarms did not fail.

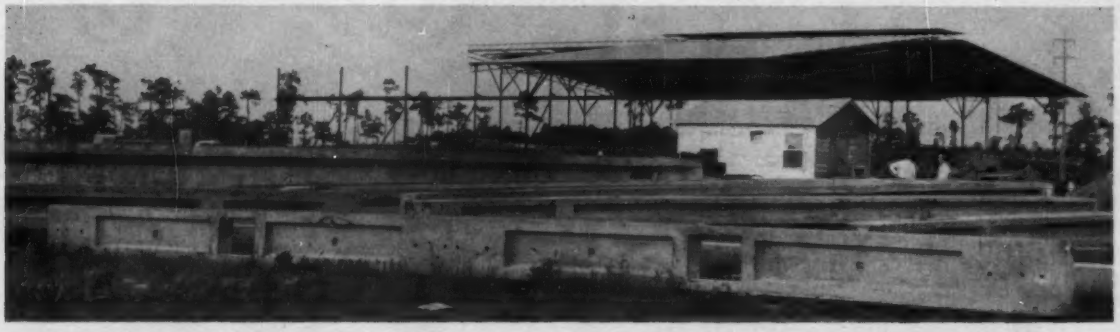
One pole, after arms and bracing had been removed, was tested with the load applied longitudinally at the top. At 3,800 lb the pole top deflected 9.67 ft, and the pole failed when the load reached 3,840 lb. Another pole, loaded transversely to 4,100 lb at the top, had not failed when the test was discontinued. As maximum soil loading had been exceeded, the pole was merely being pulled over.

The tests demonstrated that the prestressed concrete structures



COMPLETE STRUCTURES WERE ERECTED with boom mounted on a tractor tread. Special attachments fitted into grooves in poles prevent damage to the concrete

In manufacturer's yard are prestressing bed and metal casting forms



Crossarms have two holes, 10 ft from each end, to fit over tops of poles

Structures were assembled on ground. Blocks raised poles to simplify work

would be satisfactory substitutes for H-frames of Class 2 wood poles.

In 1956, Florida Power installed 51 75-ft prestressed concrete H-frames as a 9⅓-mile section of a 62.56-mile 110-kv line. The structures have the same design as the test structures.

The 75-ft poles have an I-beam shape. They are 11x16 in. at the top and 22½ x 35 in. at the base. The 39-ft arms are 8 x 29 in. and have rectangular holes in the wide side 10 ft from each end. In assembly, the crossarm is slipped over the pole tops and bolted in position 9 ft from the top. There the opening in the arm is slightly larger than the hole, providing a fit similar to a double arm. V-braces and cross-braces give rigidity.

Concrete for poles and arms has developed a strength in excess of 7,000 psi in compression. It con-

Construction costs per mile for 5 types of structures

Two-pole creosoted Southern pine H-frames	13,036
Two-pole Western red cedar or Douglas fir H-frames	13,643
Two-pole prestressed concrete H-frames	21,916*
Two-pole tubular steel rigid H-frames	23,215
Single-circuit wide-based steel towers	34,212

*Actual installed cost per mile.

sists of high-early strength cement and expanded shale products for fine and coarse aggregates. Prestressing cables are ⅜-in. diam, 7-wire strand, stress relieved grade, with a high-yield point developing an ultimate strength of 20,000 lb. Web reinforcing is ¼-in. steel on 4-in. centers.

Use of light aggregates reduced the weight of the concrete to 103 lb per cu ft. Thus the total structure weighs slightly less than 24,000 lb —10,000 lb per pole and 4,000 lb for the arm.

The structures are designed to withstand the transverse loads of 135-mph hurricanes and to deflect longitudinally without crippling under the stress of a broken conductor. Loadings on poles, three 336,400-CM ACSR conductors, and two ⅜-in. copper-clad overhead ground wires under a 45.6-lb transverse wind limit the spans to 1,250 ft as uplift forces total 31,000 lb. This span length was satisfactory for the first installation.

Structure strength, however, is adequate for spans up to 1,630 ft. To utilize the maximum span, resistance against uplift must be provided by installing precast footings. Without the footings the loaded structure with spans of 1,250 ft develops a net uplift of 21,300 lb. This is resisted by skin friction of 231 psf of buried surface. Tests in this area have indicated no movement under uplift forces resisted by skin friction up to 293 psf of buried surface.

The arm develops 5,100 lb longitudinal strength at each conductor attachment. At major crossings, in-line anchor guys develop longitudinal strength requirements.

Prestressed concrete poles and arms presented new problems in handling, transporting, assembling, and erecting. But construction was completed on schedule and in a highly satisfactory manner. Actual costs were considerably lower than estimated.

The contractor hauled poles and arms, 35 to 45 miles from the concrete plant to the job on a 3½-ton truck with a long pole trailer padded with wood planks to prevent chipping the concrete. Poles and arms were loaded on the truck by a large crane and a special attachment to fit on the poles and arms. This attachment was made of steel formed to fit around both sides of the poles at two points.

Two poles or five arms were secured on the trailer with the narrow side down. Upon arrival, the trailer was uncoupled and a second trailer attached to return for another load. The three-man hauling crew completed two trips a day.

Two Trailers Speed Job

Another five-man crew, using a TD 18 tractor with an A-frame spotted poles and arms at the proper locations along the right-of-way. Poles were placed on blocks with the tops off the ground to eliminate relifting for framing. Installation of cross arms, V-braces, and crossbraces was expedited through use of the tractor.

Pole holes were dug with augers, a 56-in. diam steel drum being used to prevent cave-ins. An air tamp was used in backfilling.

A complete structure and rigging, weighing about 30,000 lb, was erected by a 65-ft boom on caterpillar tread. This equipment was attached by a tongue to a large tractor that furnished power for lifting by means of winch and cable. The boom was guyed three ways. Winch cables from two line trucks were side guys, and the winch line from a heavy hole-digging truck the back guy.

A spreader bar for lifting the structure was made of heavy pipe and reinforced with a triangular steel plate. This bar was attached to two 20-ft steel I-beams placed in one groove of each pole to prevent damage to the concrete. Each I-beam was bolted to three steel plates in the opposite groove. Blocks and extra sheaves were attached to the boom and winches to lift the heavy structure smoothly.

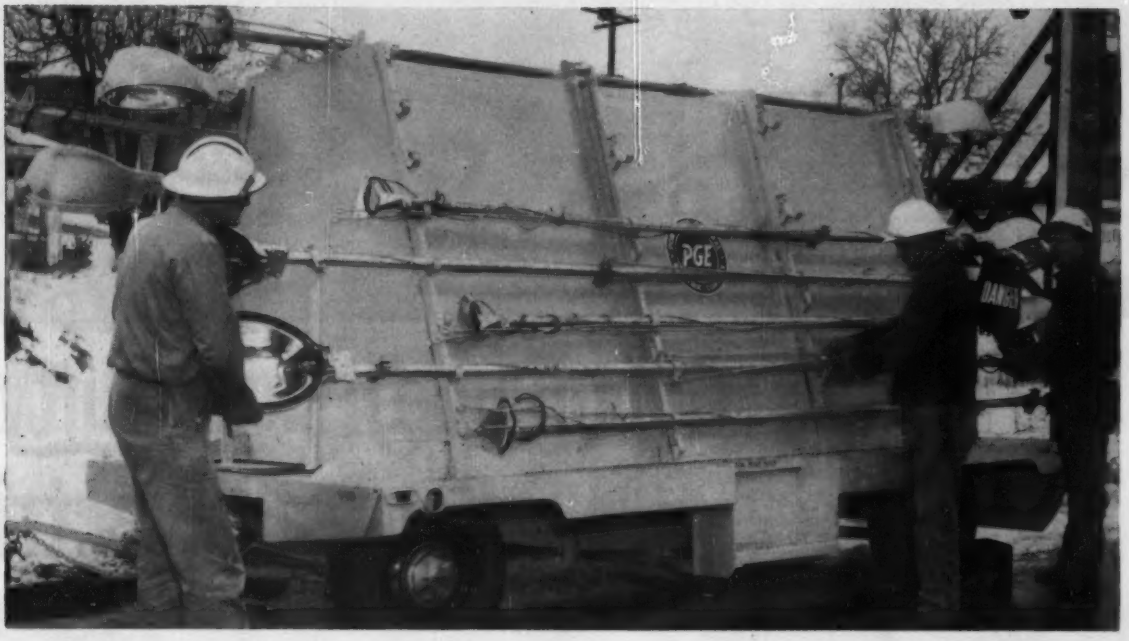
One structure was set each day for the first three days. After that, the average was two per day. Stringing was carried out in the usual manner. Concrete structures were climbed by means of step holes cast in the structure's webbing. As the top third of the pole was too narrow for step holes, a hook ladder reached the crossarm. Sometimes linemen climbed the boom and stepped off on the crossarm. Armor rodding was applied from hook ladders.

Estimates of total construction costs per mile over the same route for five types of construction are in the table. Prestressed concrete H-frame line costs 60.64% more than Western red cedar or Douglas fir wood-pole H-frame line but only 64.06% as much as the wide-based steel tower line. Studies indicate that annual expense of the prestressed concrete H-frame line will be 25% less than that of H-frames of Western red cedar or Douglas fir.

The annual cost study was based on the following factors: Prestressed concrete structure life of 50 years, wood-pole H-frame structure life of 20 years, fixed charges on depreciable investment of 19.40% for wood-pole H-frame line and 16.40% for prestressed concrete H-frame line, replacement costs of wood-pole line increasing at an annual rate of 4.25%, an annual maintenance expense for wood-pole lines of $25.35 and $7.17 per mile for prestressed concrete H-frames.

Hauling, framing, erecting, and armor rodding (excluding conductoring) of 51 prestressed concrete H-frame structures cost $707 per structure—less than 50% of the preliminary estimate. Because weather, terrain, right-of-way, and labor conditions were almost perfect during installations, costs of future installations will be slightly greater. But the increase will be more than offset by the considerably reduced manufacturing costs, which will not include the high development outlays of the initial installation.

DISTRIBUTION—Operation



Trailer Carries Street Lighting Items Safely

JACK ARMFIELD, General Line Foreman, Portland General Electric Co, Portland, Ore.

Fast and damage-free delivery of street lighting glassware, arms, and equipment is insured with a special trailer designed by Portland General Electric Co.

The trailer carries 20 arms and has room for glassware and other equipment. With the trailer, deliveries are made to three ladder-truck crews working in different locations in various parts of Portland.

To meet the requirements of a street-light bond issue, PGE put three crews into the field. But deliveries of equipment by truck were unable to meet the work schedule, and glass breakage remained a problem. Crew and shop personnel devised the trailer which is built up from an old automobile chassis.

The passenger-type spring and suspension system absorbs road shock during hauling, thereby insuring damage-free delivery of glassware and equipment. The auto's hand brake system was retained to hold the trailer at the site independently of the towing truck.

Mounted on the chassis is a light metal hood with sloping sides. Brackets and clamps on the hood form racks for carrying eight fixtures on either side and four on top. Brackets and clamps are rubber-lined to prevent damage to the galvanized hanger arms. Inside the hood is ample space for glassware and equipment.

SAFETY

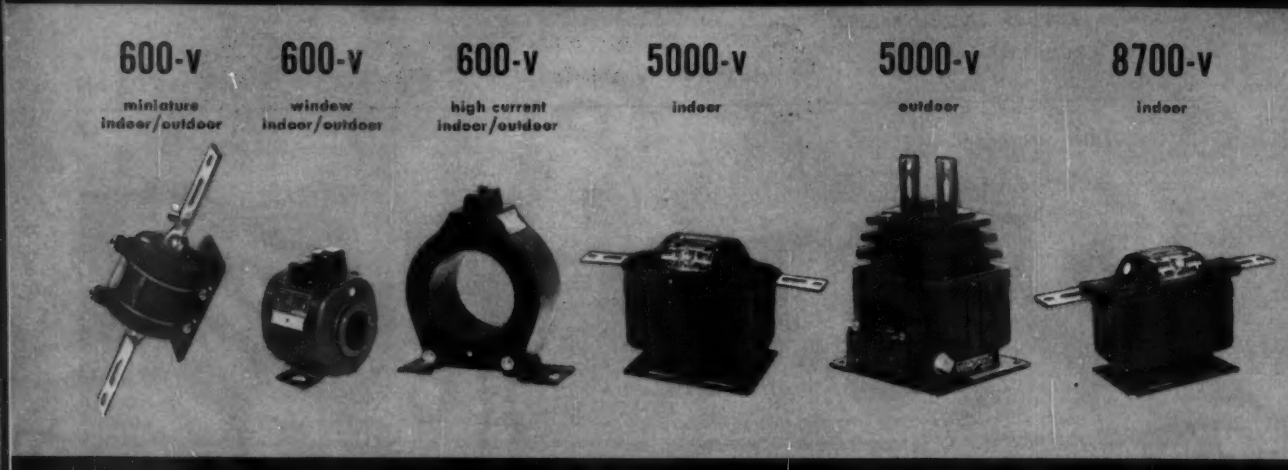
Helmet Shields Lineman from Feeder Flash

His protective helmet is credited with saving a Seattle Department of Lighting lineman from serious injuries. He was installing a jumper on a 4,160-kv feeder on a corner pole when the jumper twisted in his hand and came in contact with a phase above. The flash was only a few inches above his head.

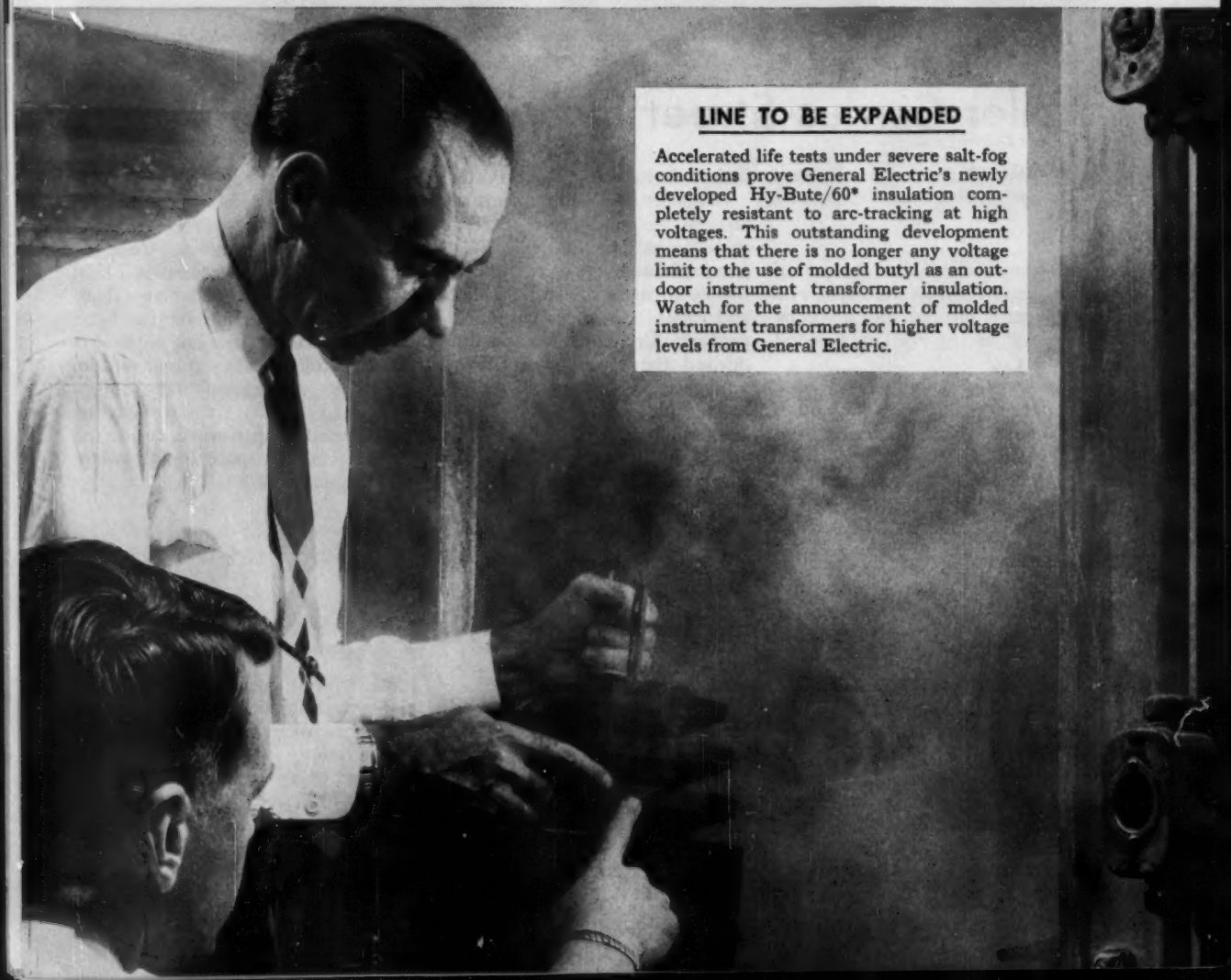
The man received superficial burns on his face and neck. As his helmet took the brunt of the flash, it saved him from serious, possibly fatal injuries.

The helmet is high-pressure molded in one piece from a special shatterproof thermoplastic material of high dielectric resistance. It protects its wearer from impact and penetration, its round smooth crown being designed to deflect falling objects.

(*More How To on page* 72)



NOW You Get Benefits of Butyl-General Electric



LINE TO BE EXPANDED

Accelerated life tests under severe salt-fog conditions prove General Electric's newly developed Hy-Bute/60* insulation completely resistant to arc-tracking at high voltages. This outstanding development means that there is no longer any voltage limit to the use of molded butyl as an outdoor instrument transformer insulation. Watch for the announcement of molded instrument transformers for higher voltage levels from General Electric.

COMPARISON CHART

G-E	X	X	X	X	X	X	X	X	X
MFR-A	X			X					
MFR-B		X	X						

Now General Electric offers molded instrument transformers in a complete line from 600 volts through 15,000 volts.

Molded Construction in all these Instrument Transformers

New 8700-volt indoor and new 8700-volt outdoor current transformers make line complete from 600-v through 15-kv

Molded in Butyl or new Hy-Bute/60* insulation, these nine General Electric instrument transformers give you many cost-saving benefits.

Maintenance is sharply reduced because butyl is corrosion resistant. There are no metal tanks to rust out—no painting is ever required no matter how corrosive the atmosphere. Porcelain bushings, which can break during installation or operation, have been completely eliminated and continuous thermal ratings of 150% to 200% on many models minimize the need for replacing transformers with higher ratings as loads increase.

Stock needs are reduced because many of the new butyl designs replace several older types. The 600-volt butyl types provide greater application flexibility because they can be used either indoors or outdoors. You save money too, since each new butyl-molded design is priced the same as the least expensive of the older models it replaces.

Easier Installation results from the smaller size and lighter weight of butyl-molded transformers. In addition, they can be mounted in any position.

Safer and more reliable operation is assured because flame-resistant butyl will not support fire. Design features such as increased creepage distance add to the dependability of this complete family of molded instrument transformers.

Only General Electric brings you all the advantages of butyl-molded construction in a complete line of indoor and outdoor current transformers from 600-v through 15-kv. For details, call your General Electric Apparatus Sales Representative or request bulletin number GED-3112 from Section 581-3, General Electric Company, Schenectady 5, New York.

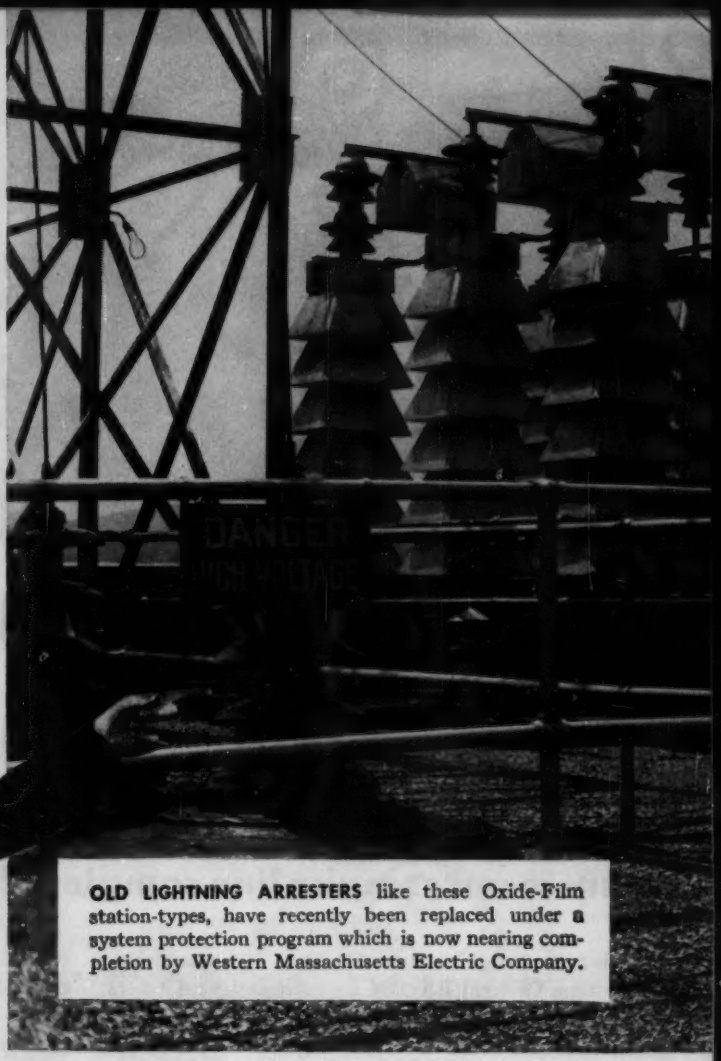
LIVE BETTER ELECTRICALLY

* *Trade-mark of General Electric Co.*

Progress Is Our Most Important Product

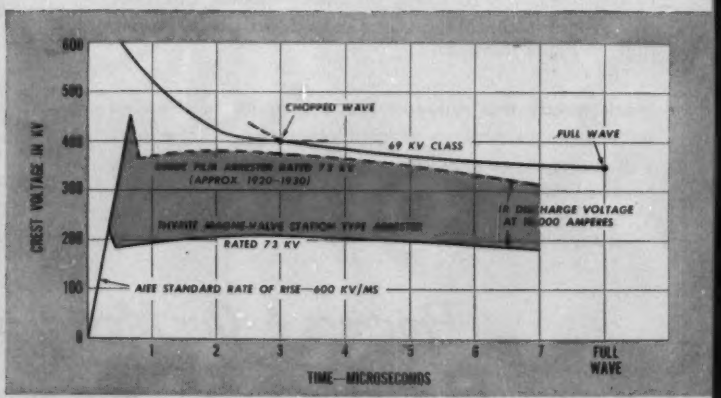
GENERAL ELECTRIC

LIGHTNING ARRESTERS



OLD LIGHTNING ARRESTERS like these Oxide-Film station-types, have recently been replaced under a system protection program which is now nearing completion by Western Massachusetts Electric Company.

W. J. RUDGE, MANAGER—Lightning Arrester and Cutout Engineering, is shown here with a new 73-Kv Magne-valve Station-type arrester. It has 52% lower impulse sparkover voltage, and 47% lower IR discharge voltage than the Oxide-Film arresters shown, representing a degree of protective efficiency heretofore unobtainable.



COMPARISON OF IMPULSE VOLT-TIME coordination curve for power transformer on 69-Kv ungrounded neutral system using oxide-film arresters and modern Thyrite* Magne-valve arresters. Colored area shows the improvement in the margin of protection obtainable with modern General Electric Thyrite Magne-valve arresters.

*Registered trade-mark of G.E. Company.

How do you decide when your old lightning arresters need replacing?

Western Massachusetts Electric, like many progressive utilities, for over 25 years has been continually re-evaluating its stations' lightning protection equipment

Determining the condition of all its *critical equipment* —then doing something about it—is just one of the ways Western Massachusetts Electric Company has been meeting the growing demand for electric power.

Considered in this category of *critical equipment* are the utility's large number of station-type lightning arresters. Surveys of all arresters during the past quarter century revealed many of such age and condition that their degree of protective efficiency was questionable. And, costs of maintenance were increasing every year.

Rather than risk its valuable equipment with these antiquated station arresters, an Adequate Protection Program was established to replace older units with modern arresters.

Thus, on an integrated planned program of equipment evaluation—which stresses *protection* levels—Western Massachusetts Electric Company regularly inspects all components of its extensive system, with special attention given to every station's lightning protective equipment.

Realistic evaluation of your station lightning arresters can help you establish an Adequate Protection Program of your own. Why not let General Electric engineers assist you in planning such a program to meet your systems requirements?

For further information on lightning arresters, contact your nearest G-E representative or write to General Electric, Section 432-19, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

SUBSTATION—Operation

Special Lever Aids in Replacing OCB Mechanisms

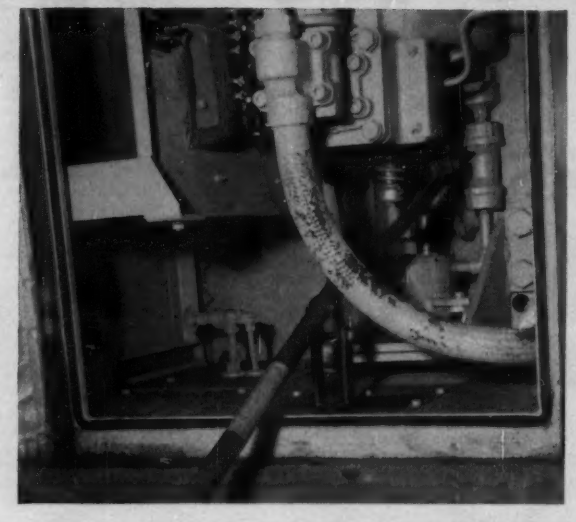
O. P. HAMILTON and R. H. STEGNER, Philo Electric Maintenance Dept, Ohio Power Co, Philo, Ohio

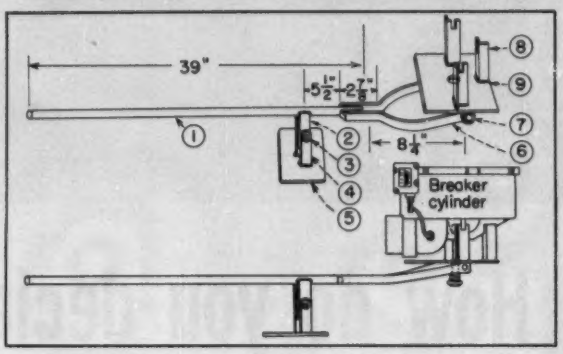
A special lever for raising and lowering the main cylinders of oil circuit breaker mechanisms has been developed by this department. It has reduced labor and time about 80% in removal and replacement of this heavy part, in contrast with the former method involving use of threaded rods.

There is a possibility that the device can be applied also to Type MA-15 mechanisms.

With reference to the drawing, the device consists of (1) ¾-in. pipe; (2) ¼x1x2½-in. strap iron welded to pipe and drilled for ⅜-in. bolt hinge pin; (3) ⅜x2½-in. bolt for hinge joint; (4) ¼x1x3⅞-in. strap iron welded to plate (5) drilled for bolt hinge pin; (5) ⅛x6x6⅞-in. plate; (6) ¼x1x12-in. strap iron drilled for hinge pin (7) and welded to pipe (1); (7) ⅝-in. nut welded to plate (9) for ½x1½-in. bolt hinge pin; (8) 1½x5-in. angle iron spaced and notched 1-in. deep and ⅝-in. wide to fit ribs on cylinder; (9) ⅛x8-in. square plate with 2-in. hole in center.

Lever plate (9) with its slotted lugs (8) is placed under the breaker cylinder which can then be lifted with ease by pressing on lever (1) whose fulcrum rests on plate (5).





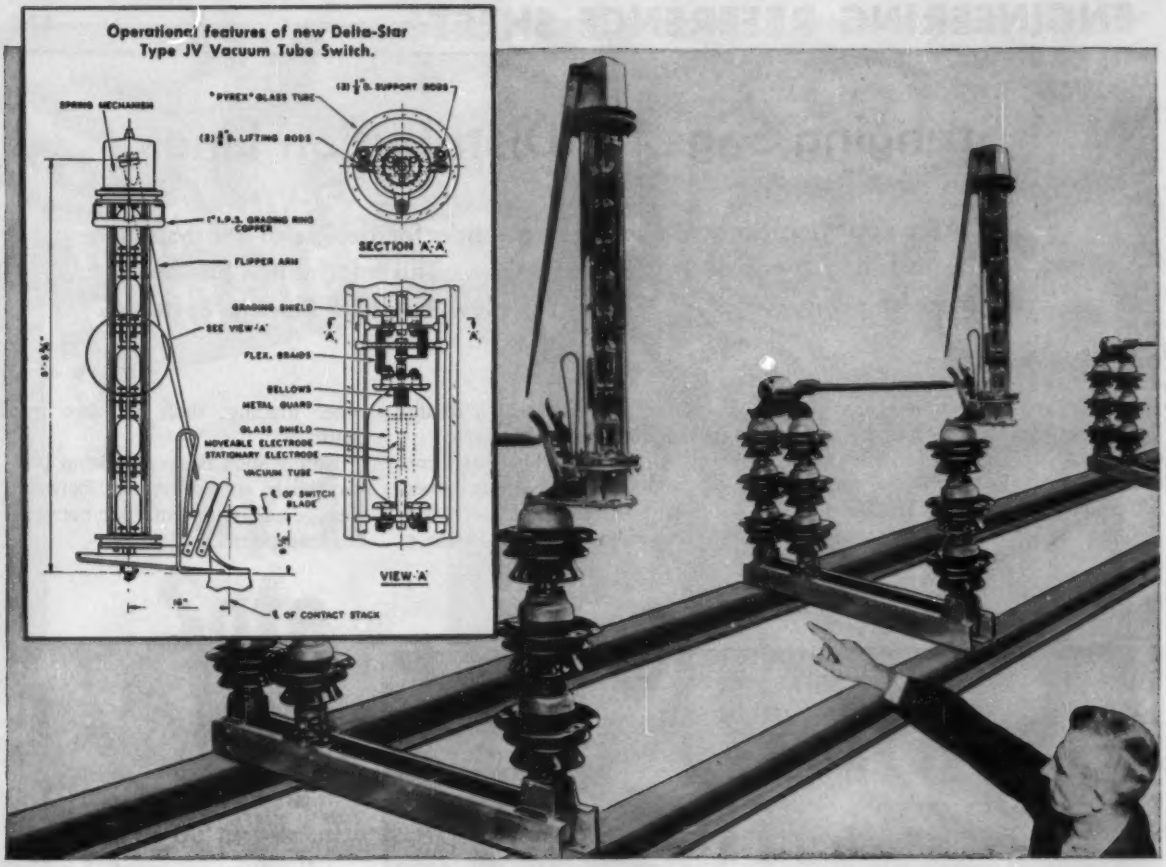
GENERATION—Maintenance

Eases Replacement Of Boiler Manhead

FAY SHANKS, Mill Street Plant Superintendent, Indianapolis Power & Light Co, Indianapolis, Ind.

Replacement of manheads in old boilers has been simplified at the Mill Street plant of Indianapolis Power & Light Co by the use of a specially devised jack and leverage arrangement.

The jack and leverage arrangement, made from scrap material, consists of a screw jack to facilitate height adjustment, capped with a roller fulcrum. Riding in the roller fulcrum is a lever built to grip the studs of a manhead. The manhead is pulled into place, the dogs are secured, and the lever is manipulated easily to free the device. With this new tool, one man can replace twice the number in half the time.



DELTA-STAR Announces NEW High Voltage MKV-40 Interrupter Switch

Provides positive current interruption for load and capacitor switching.

The new Delta-Star MKV-40 Interrupter Switch is especially well suited for switching capacitive loads. A series of vacuum switches having extremely high dielectric strength does the job. Ratings 34.5 kv to 138 kv are now available.

Vacuum switches are in the circuit only during the interrupting cycle. Interruption occurs at first current zero with no restrikes. Jennings vacuum switches used in this device require no maintenance.

Get all the facts about this new Delta-Star switch from your nearest representative. Or, write *Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton St., Chicago 12, Ill. Offices in principal cities.*

HKP DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

Divisions of H. K. Porter Company, Inc. are: Alley Metal Wire, Connors Steel, Delta-Star Electric, Henry Disston, Laclede-Christy, Leschen Wire Rope, McLain Fire Brick, Quaker Pioneer Rubber, Quaker Rubber, Riverside Metal, Vulcan Crucible Steel, W-S Fittings.

Stringing Sags for Distribution Lines

Accompanying data will serve as a guide for design of short-span lines with ruling spans of 150 ft and below. This information has been adapted from Distribution Standards of New England Electric System.

Sag data are compiled for various types of wire indicated in the tables.

Sags for "in-between" temperatures and span lengths and for non-standard wire sizes may be determined by interpolation of these data.

Conductors of less strength require correspondingly greater sag.

New wire is defined here as a conductor that has not been stretched.

Old wire is that conductor which may have been subjected to ice or other loading, such as large tree limbs.

Ruling span is average span plus two-thirds the difference between average and maximum span between deadend points.

Table 1. Stringing Sags for New Wire

Temp., deg F	Span Length, ft				
	100	125	150	175	200
			Sag, in.		
30	6	9	13	18	23
60	8	13	18	25	32
90	11	17	25	34	44

Basis for Table 1: 18-in. sag at 60 F for 150-ft ruling span and heavy loading conditions.

New wire strung in accordance with Table 1 will have sags as given in Table 2 after the wire has been loaded and stretched.

Table 2. Stringing Sags for Old Wire

Wire			Maximum Loaded Tension, lb	Temp., deg F	Span Length, ft				
AWG or Mcm	Type	Bare or Covered			100	125	150	175	200
					Sag, in.				
4-7/1	ACSR	Bare	850						
		Covered	900						
4/0	All Al	Bare	1550	30	8	12	18	25	32
		Covered	1700	60	11	18	26	35	46
336.4	All Al	Bare	2150	90	15	23	33	45	59
		Covered	2300						
4/0	SD Cu	Covered	2750						
1/0	ACSR	Bare	1300						
		Covered	1400						
3	HD Cu	Bare	1050	30	7	11	16	22	29
		Covered	1150	60	9	14	20	27	36
1/0	HD Cu	Bare	1650	90	12	18	26	35	46
		Covered	1750						
4/0	HD Cu	Bare	2850						

Protection is the big reason for using breakers —so why take less than the best?

Get positive protection with Allis-Chalmers tank-per-phase construction. Today's low reactance systems with corresponding high fault currents require maximum protection. Three tanks eliminate danger of internal phase-to-phase flashover usually caused by line-to-ground fault.

Tank-per-phase construction has other advantages. Tanks are smaller, easier to handle, oil contamination is reduced, and only the faulted phase is affected.

Here's big breaker construction at no extra charge.

These breakers also feature: AEIC-NEMA standardized control wiring; two vertical breaks per phase, using time-tested *Ruptor* device; self-aligning, self-wiping tulip and bayonet contacts.

Ask for Bulletin 71B7946 for the complete story. Contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Ruptor is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-5143

NEMA MAJOR ELECTRIC APPLIANCES

Total Industry Sales—Number of Units (Including Exports)

	Year 1955	Year 1956	% Change 56/55	Est Year 1957	Est % Change 57/56
Electric Dehumidifiers	95,000	275,000	+189.5	300,000	+09.1
Electric Dishwashers	295,000	400,000	+35.6	475,000	+18.7
Electric Food Waste Disposers	520,000	590,000	+ 13.5	650,000	+10.2
Electric Farm and Home Freezers	1,100,000	975,000	− 11.4	1,000,000	+02.6
Electric Ranges:					
Standard	1,400,000	1,200,000	− 14.3	1,200,000	0
Built-Ins	200,000	385,000	+ 92.5	425,000	+10.4
Total	1,600,000	1,585,000	− 0.9	1,625,000	+02.5
Electric Refrigerators	4,200,000	3,700,000	− 11.9	3,900,000	+05.4
Electric Storage Water Heaters	900,000	870,000	− 03.3	900,000	+03.4
Total Appliance Shipments (in billions of dollars)	$4.68	$4.8	+ 02.4	$5.15	+07.3

NEMA Appliance Review: '56-Good; '57-Better

Substantial gains among newer electrical appliances are balanced against losses among older ones. Some recovery is predicted for '57

The public's constant demand for something new and better in electrical living pushed the sales of four major appliances to record peaks in 1956, and resulted in predictions that show heavy gains during 1957, according to spokesmen for the National Electrical Manufacturers Association.

The four leading electric household appliances, all of which are included in NEMA's Major Appliance Division, are: built-in electric ranges, electric dishwashers, electric food waste disposers and electric dehumidifiers. Sales increases among them ranged from 15% to a top of almost 200% in 1956 over 1955, NEMA reported.

Some Appliances Up, Some Down

The association's year-end appliance review showed that, while shipments of stable items such as standard electric ranges, electric refrigerators and freezers and storage water heaters dropped off in '56 anywhere from 3 to 15%, other sales went up. Dehumidifiers almost tripled; sales of electric built-in ranges almost doubled; electric dishwasher sales upped 35%; and food waste disposers increased almost 15%.

The shift to *built-in ranges* rather than standard ones, is of particular significance. While the latter dropped 200,000 units from 1,400,000 in 1955 to 1,200,000 in 1956, the built-ins went up 185,000—200,000 in '55 to 385,000 in '56. Thus, total range sales stayed practically at the 1955 level of 1,600,000 units; this, despite a decrease in new home construction. This trend in built-in electric ranges is expected to continue in 1957. Estimates for the coming year are set at 425,000 built-ins out of an electric range total of 1,625,000 units.

Electric dishwashers are rapidly approaching the half-million mark. Shipments went from 295,000 units in 1955 to 400,000 in 1956, and are expected to go to 475,000 in 1957.

Electric food waste disposers are becoming increasingly popular. From 520,000 units in '55, they climbed to 590,000 in '56, for an increase of 13.5%. Predictions for '57 place disposer sales at an all time high of 650,000 unit, for a gain of a little more than 10%.

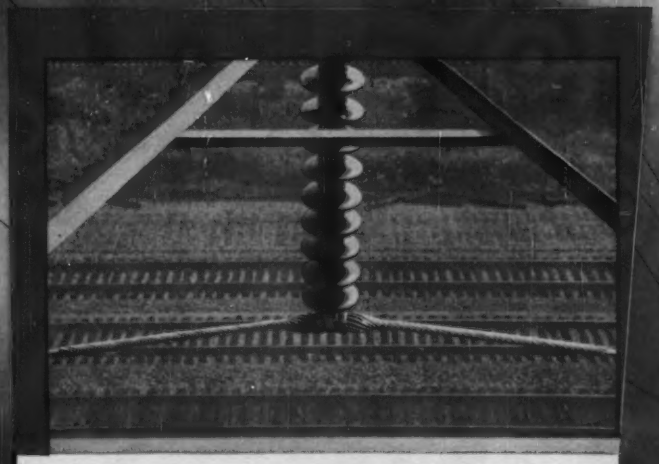
The real bonanza item for 1956, is the *electric dehumidifier*. in 1955 95,000 units were sold; then in 1956 they went to an incredible 275,000 units. But they are expected to slow down in '57 to 300,000 units, a 10% rise above 1956.

These four major appliances are all relatively new. While the sales increases of the industry's staple items—*the electric refrigerators, freezers and storage water heaters*—are not as so spectacular, they are expected, as in the past, to furnish the real strength in the industry's business picture. NEMA statisticians expect they will recover some of the loss experienced in 1956, and will account for a total sales of some 6,000,000 units during '57. In '55 they accounted for total sales of 6.2 million; in '56, 5,520,000.

Dollarwise, sales in 1955 were $4.7 billion; in 1956 they added up to $4.8 billion, for an increase of 2.4%. In 1957, the grand total is put at an estimated $5.2 billion.

Material for the National Electrical Manufacturers Association 1957 major appliance predictions was gathered from NEMA members, non-members, manufacturing and trade organizations, industry publications, (including ELECTRICAL WORLD), the United States Department of Commerce, and other interested sources.

(*More Selling on page* 78)



PLP ARMOR-GRIP SUSPENSION UNITS — THE ULTIMATE IN CONDUCTOR PROTECTION

The PLP Armor-Grip Suspension Unit is an entirely new concept in transmission design. Unlike old style bolted clamps that exert concentrated clamping stresses, Preformed Armor-Grip Suspension Units cradle the conductor in neoprene. This protects the conductor, yet the Preformed AGSU Rod components firmly grip the conductor, distributing the tensile load throughout their length. With Preformed Armor-Grip Suspension Units there are no parts to loosen in vibration. Because of their smooth contour and large diameter, corona emission, radio influence and arc-over are minimized. These, plus easier installation, are some of the reasons why more Utilities are adopting this new type of suspension. Write for more information today.

Dept. No. PR1A

PX-79

PLP Armor-Grip Suspension Units support these 132 KV Cleveland Electric Illuminating Company lines.

PREFORMED LINE PRODUCTS CO.

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

Telephone: Cleveland EXpress 1-3571

Made in accordance with or for use under one or more of the following U. S. Patents: 2,722,393; 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.

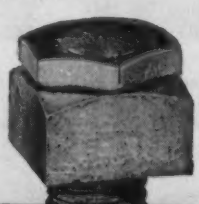
Widely used on

- Insulator Pins
- Crossarm bolts and braces
- Clevises and clamps

- Eliminate checking and re-tightening
- Eliminate radio interference due to loose hardware

Every bolt-and-nut assembly locked with PALNUT Lock Nuts stays tight, despite weather, wind, stress and vibration. PALNUTS, tightened on top of the regular nuts, prevent loosening and falling off. Very low in cost—easily, speedily applied — require little space—may be used on new or existing assemblies. Hot dip galvanized, silicon bronze and other materials and finishes. Stocked by all leading pole line hardware manufacturers.

The PALNUT Co.
51 Glen Road
Mountainside
N. J.



PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

SELLING *(Continued)*

New York's 3rd Avenue Gets Lit Up

New York City's picturesque Third Avenue, sans its famous "El," recently received another distinction: In addition to rapidly becoming one of the city's smartest avenues, it is now the longest fluorescently-lighted street in the world. 539 luminaires have been installed along the 7½-mile stretch from Brooklyn Bridge to the Harlem River.

The luminaires, built by Westinghouse Electric Corp, each house four 72-in. fluorescent lamps, which give off as much light as 1,000 watts of incandescent bulbs. They are mounted 26 ft above the street and are tilted upward at a 30-deg angle to light the full width of the avenue.

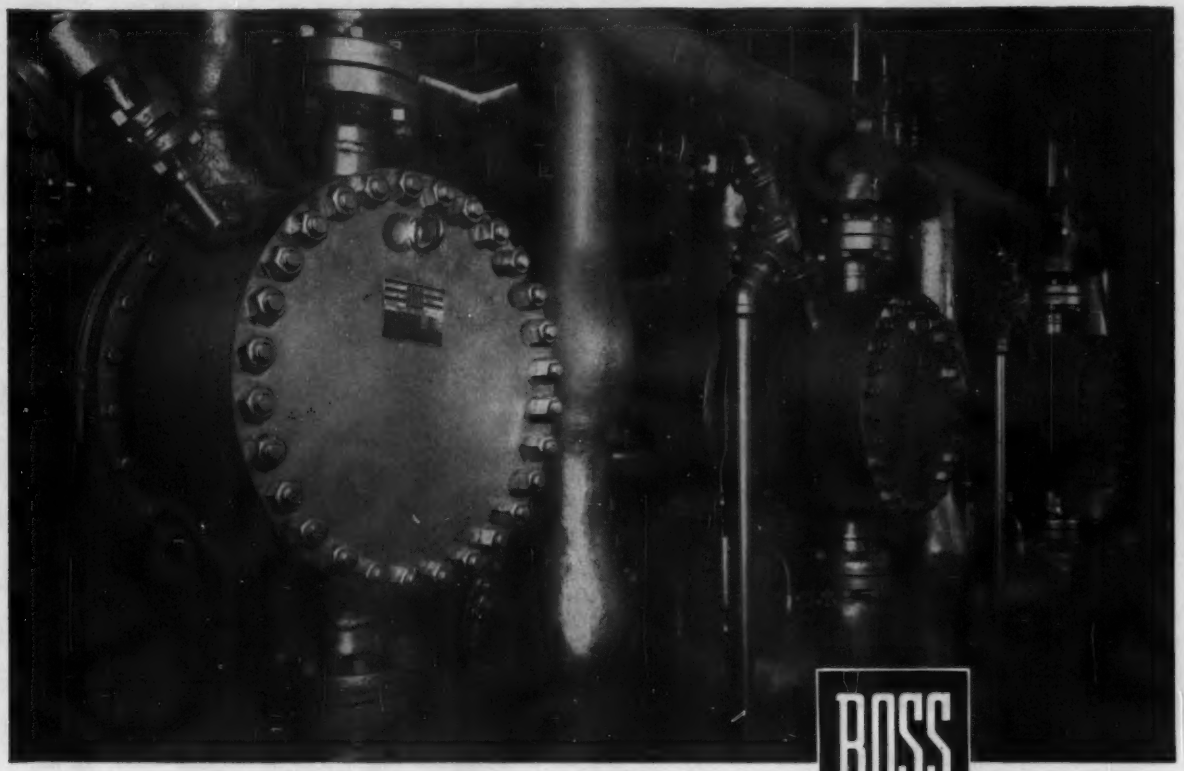
LIGHTING NOTES

• To help utilities meet their needs in selling the commercial lighting market, Edison Electric Institute has prepared a "Catalogue of Lighting Demonstration and Exhibit Materials." It contains illustrations and information on useful sellings tools needed by the lighting salesman in the field. Props and other material available in the industry are shown, giving descriptions and methods of application. Prices: $1.00 to EEI members, $1.50 to non-members and companies out of the USA.

• There are 14% more fixtures and 25% more kw demand to the average Certified Lighting job than seven months ago, according to an analysis recently made up to Nov. 1, 1956, recently made by the National Lighting Bureau of NEMA. As of Mar. 31, 1956, the average certified lighting job had 42.7 fixtures with a 7.43-kw load; The jobs reported up to Nov. 1 averaged 48.7 fixtures with a 9.23-kw load.

• Louisiana Power & Light Co's "We want Qually T" fall lighting campaign closed December 7th after spreading success over the utility's service area. During the eight-week campaign, 57 new and 16 old homes were light conditioned. Rooms which qualified for the light-conditioned tag totaled 341; 1,082 instances of improved lighting were reported.

(*More Selling on page* 80)



ROSS

THE ROSS STORY

Special Heat Exchange Equipment for Power Plants

Simply stated, Ross designs and manufactures heat exchangers for virtually all conditions and applications, particularly units of a highly specialized nature, such as high pressure power plant equipment... bleeder heaters and fuel oil heaters, for example.

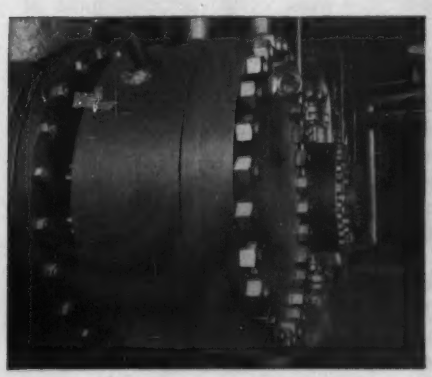
The installation of 6 Ross High Pressure Fuel Oil Heaters (illustrated) at the Pacific Gas and Electric Co.'s Station P Steam Plant in San Francisco is typical. Featuring forged oil channels with integral tube sheets and a double tube sheet arrangement to insure against any possibility of fuel oil contaminating the steam system, these rugged units demonstrate Ross' resourcefulness and experience in dealing with both the average and the specialized power engineering problem.

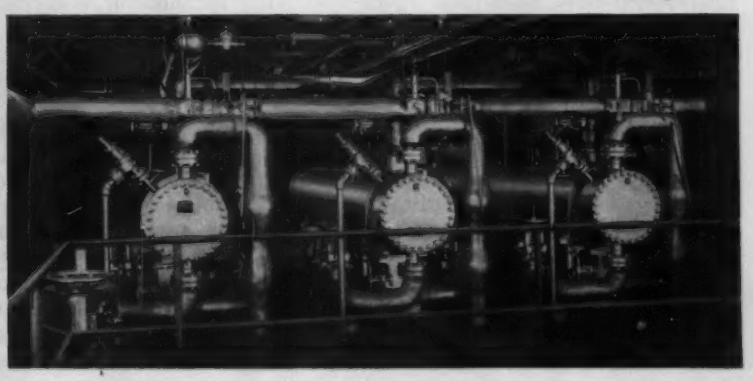
Your requirements, too, can be met with the same, exacting Ross attention to details. Inquire now. Ross offices are in all principal cities.

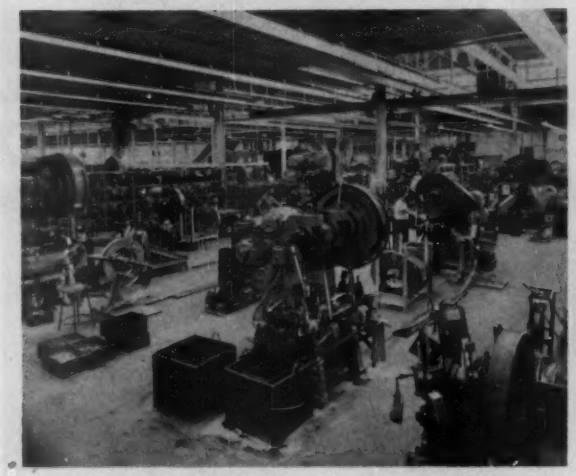
For recommendations on specialized heat exchangers, as well as on surface condensers, turbine oil coolers, engine oil and water coolers, compressor inter and after coolers and related power plant equipment, you'll profit by consulting a Ross engineer.

ROSS HEAT EXCHANGER

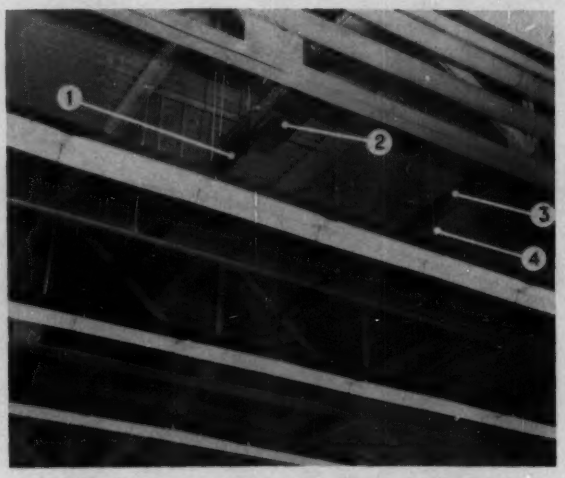
Division of AMERICAN-Standard







LAMPS RUN AT 200 MA in lower areas, 300 ma in monitors, maintain 80-ft-c min in all manufacturing areas



BREAKERS (2) TAP 3-PHASE duct (1) to feed 220/110-v transformer, single-phase duct (3), and luminaires (4)

Bright Future for Enlightened Metal Parts Firm

A carefully planned lighting system, installed in new manufacturing facilities, has paid off in increased output, better workmanship, an improved safety record and higher employee morale for The Greist Mfg. Co., New Haven manufacturer of precision metal parts for sewing machines, automobiles, and aircraft. Today the company estimates that its 532-man force can produce as much as 1200 men working under the old conditions. Overall efficiency is up 200%.

In inspection, which accounts for about 10% of the total personnel, volume is way up; costs for both new and reworked pieces have dropped. Plating, machining and assembly operations show similar results. And the improved lighting conditions have made these operations much safer, tumbled man hours lost through accidents to a new low. Moreover, in its new modern plant, Greist can now do contract work, to get maximum productivity from both machines and employees.

Plug-in bus duct is used throughout the plant, both for the distribution voltage and the utilization voltage. Consequently, the system is highly flexible. Branch circuits can be added easily whenever and wherever they are needed. When production lines are rearranged, the entire system can be disassembled and relocated with no loss of materials. For maintenance and repair, any row of fixtures can be disconnected without interrupting service to the remaining fixtures. And the simpler installation and maintenance means less manhours and lower operating costs.

With the new installation, the lighting load is as big as the power load. The manufacturing areas have a total of 3400 porcelain enameled luminaires, set in continuous rows on 10-ft centers. Each luminaire holds four, 96-inch, 4500-degree, white T-8 slimline lamps. Slimlines were chosen for their neatness, adaptability to 200 or 300-ma operation, and maintenance features, notably their rugged, push-pull sockets. Illumination is designed for 100 ft-c, with a minimum of 80 ft-c in all manufacturing areas.

These areas are divided into a series of low bays, separated by monitors into high bays. In the low areas, which have a 19-ft ceiling, the luminaires are set 15 feet above the floor and operated at 200 ma. In the high areas, where ceilings are 26-ft high, the lamps are set at 19 feet and operated at 300 ma. The higher current increases the lumen output by 25% and more than compensates for the increased light loss to the side walls. In all, 1844 fixtures are operated at 300 ma, 1556 at 200 ma.

Main distribution system is 3-phase, 220-v bus duct system, which may be tapped wherever required. Power is fed through circuit breakers to the lighting transformers. Single-phase 110-v power from the transformers is fed through 50-amp. breakers to single-phase bus duct which, in turn, may be tapped at any convenient point to feed the luminaires.

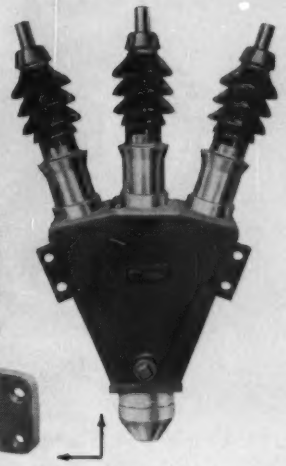
Planned maintenance is part of the new lighting. All new lamps are dated with a grease pencil. Most lamps last at least two years. Low bay lamps are replaced as soon as the ends darken. Lamps in the high bays are checked and replaced on a 3-week cycle. Because most of the high fixtures run parallel to the production lines, replacements are usually made on Saturdays.

Individual fixtures are wiped clean with a damp rag whenever a tube is replaced.

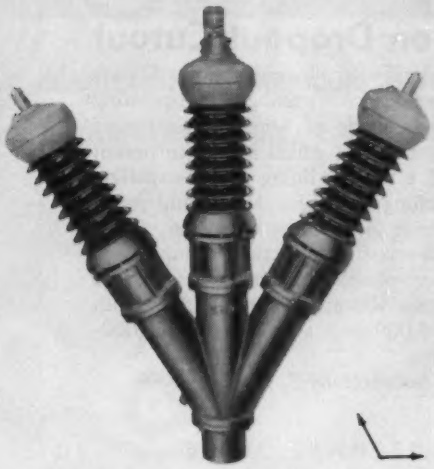
In addition all lighting is checked with a foot-candle meter. In the two-week plant shutdown periods in August and December. Wherever necessary, the luminaires are thoroughly cleaned with soap and water, with first priority going to the dimest areas.

G&W POTHEADS *Recognized standard of the industry since 1905*

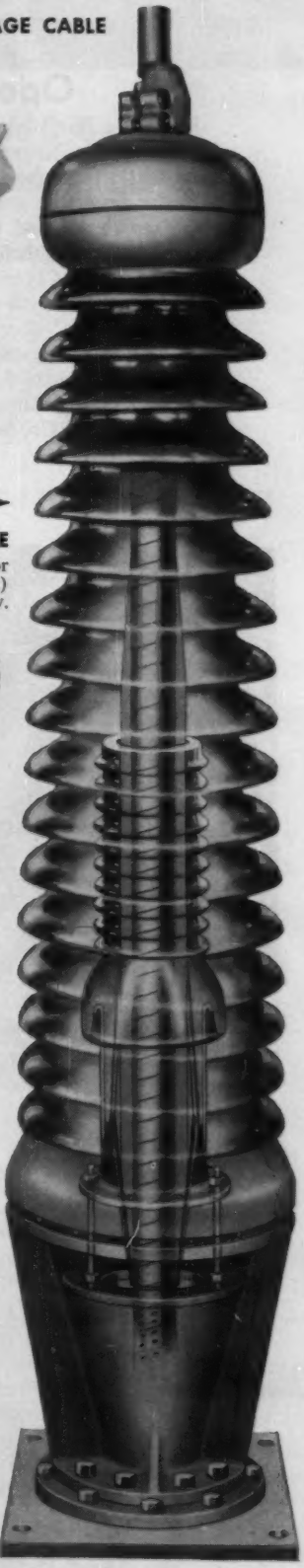
A TYPE AND SIZE OF PROVED DESIGN FOR EVERY HIGH VOLTAGE CABLE

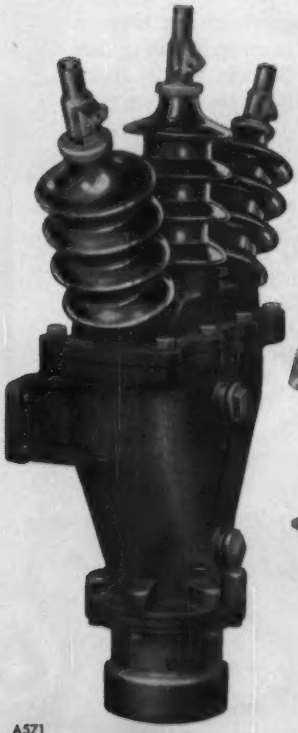


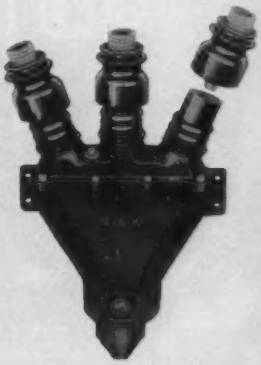
TYPE "ST"
Soldered Porcelain
Gasketless
Listed in Bul. AA56

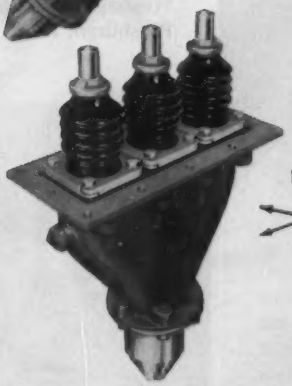


TYPE "ATA"—HIGH PRESSURE PIPE TYPE
Type "ATA" (above) for high pressure oil or gas filled generator cables. Type "ATA" (right) for high pressure oil filled cables, up to 230 Kv.









TYPE "ES" POTHEAD
Disconnecting style. Listed in Bul. AB51 and priced in Bul. AB57-P.

TYPE "T" CAPNUT
Single conductor—Bul. AB56. Multiple conductor in various shapes are listed and dimensioned in Bul. AB51 and priced in Bul. AB57-P.

A571

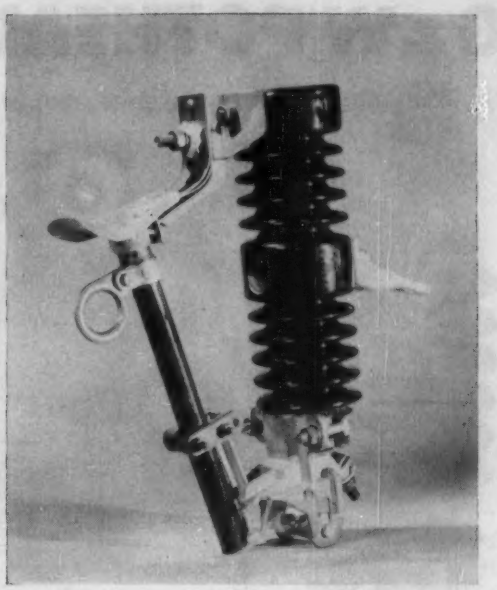
No matter what your high voltage cable terminating problem, you will find G & W cooperative and helpful. Get in touch with our factory or our nearest representative.

G & W ELECTRIC SPECIALTY CO.
3500 W. 127th St. BLUE ISLAND, ILL.

Representatives in principal cities of U.S.A., Mexico and South America
Also manufactured in Canada by Powerlite Devices, Ltd., Toronto, Montreal, Vancouver

NEW EQUIPMENT

Open Dropout Cutout



Here is a line of heavy-duty open-dropout cutouts designed to offer longer service life and greater operating economy. Fuse tube is made of fibreglass-reinforced polyester resin, the strength of which is said to permit a thinner sheath and a thicker lining of arc-expelling fiber, thereby lengthening tube life. Hinge and metal parts are made of bronze to minimize corrosion. Other features include: bird-proof construction, compression clamped fittings, silver-plated contacts, high-pressure latch. Available in two 100-amp ratings: 15 kv with interrupting rating of 4,000 amp; and 7.8 kv with 5,000-amp interrupting rating.

General Electric Co, Schenectady 5, N. Y.

5-Kv Circuit Breaker

This 5-kv magnetic circuit breaker with a 2-cycle interrupting time has been developed for use with 4.16-kv distribution systems. Designated type 50-DHHS, the 600-amp breaker has an interrupting capacity of 30,000 amp (40,000 momentary). Mechanical refinements are said to permit a contact parting time of ¾ cycle after closing trip coil. Closing current is approximately 90 amp; trip current is 25 amp. Uses standard relays, such as manufacturer's Type CO instantaneous trip.

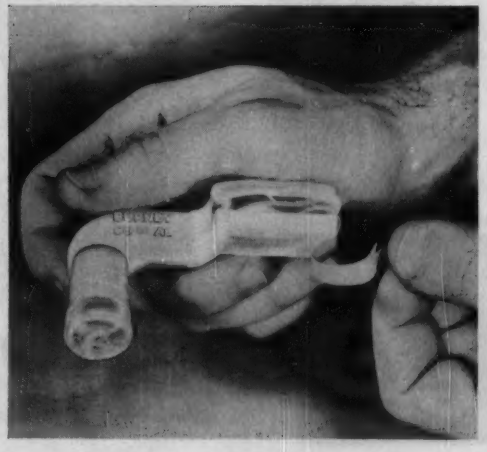
Westinghouse Electric Corp, Pittsburgh, Pa.

Pre-filled L-type Connectors

Tubular and open groove ELTAPS, L-type compression connectors, *prefilled with joint compound,* are now available for conductors from No. 6 to No. 2 and taps from No. 10 to No. 2. The manufacturer claims most failures in aluminum connectors are due to lack of this oxide-penetrating, corrosion resisting Penetrox A compound. The compound is sealed in place by a plastic coating which is removed by a rip tape when the connector is ready for use. Tapes are color-coded for cable size indentification.

Burndy Corp., Norwalk, Conn.

(*More New Equipment on page* 86)



For cost conscious engineers...

Unique adaptability of Sangamo Type R Current Transformer encourages simple, economical installations

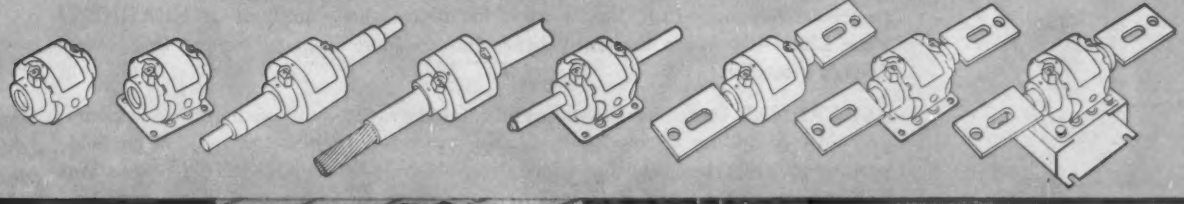
Use this Sangamo (Type R) Current Transformer as a bar-primary-type, a window-type, with or without an auxiliary mounting plate.

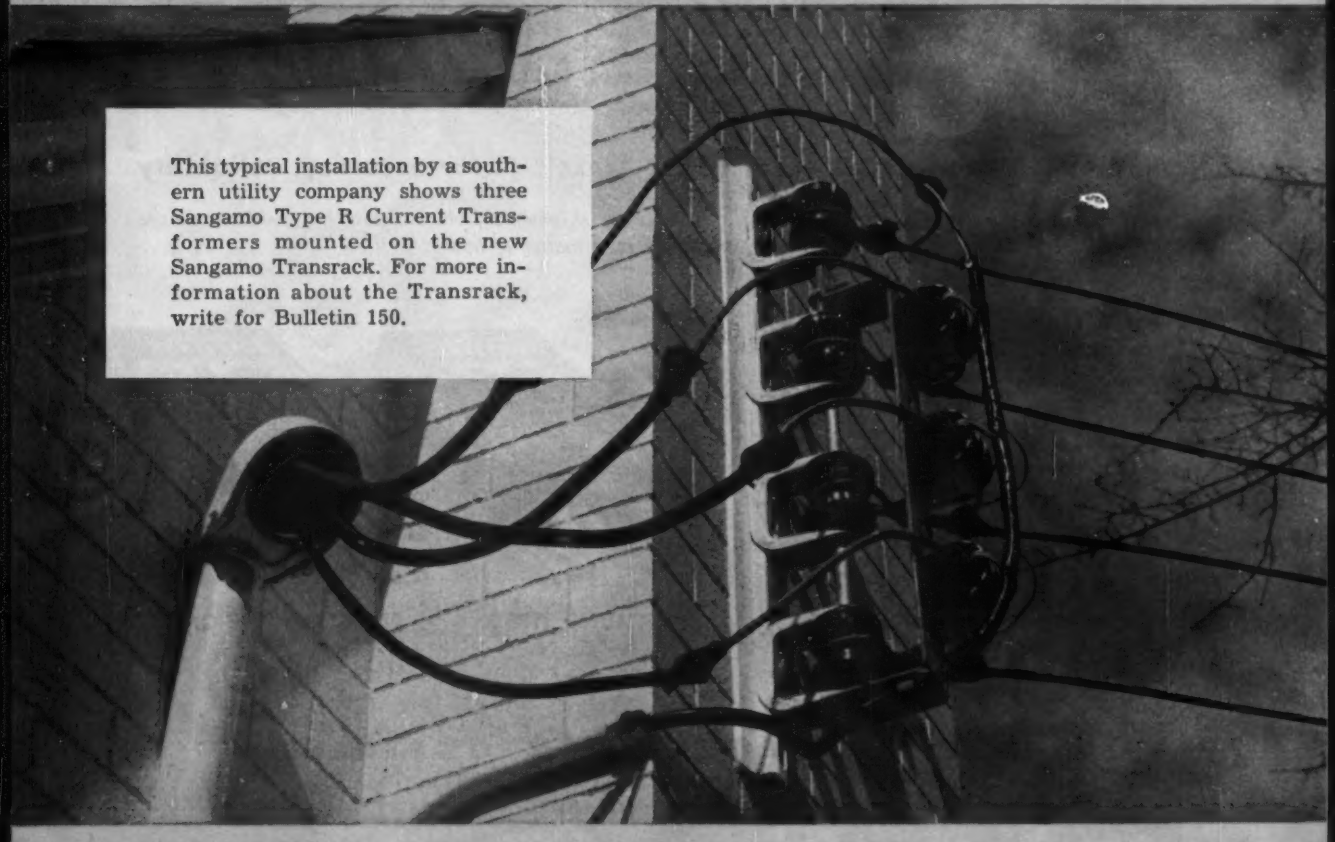
The Type R is light enough to be supported by the primary conductor only.

Type R's are encased in a high impact, phenolic shell, filled with a thermo-setting plastic that eliminates voids and prevents moisture from reaching core or windings.

Full information is given in Bulletin 501... be sure to write for your copy today.

EIGHT VARIATIONS OF ONE BASIC TRANSFORMER





This typical installation by a southern utility company shows three Sangamo Type R Current Transformers mounted on the new Sangamo Transrack. For more information about the Transrack, write for Bulletin 150.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

SM55-9

KEARNEY DEPENDABILITY *in Action*

. . . serving the power lines of America

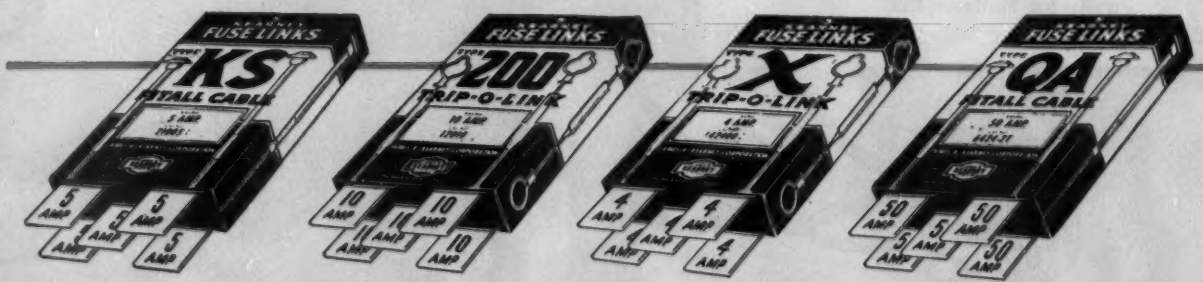
Testing . . . testing . . . *testing!* That's the reason behind KEARNEY Fuse Links' stand-out dependability. That's why, for many years, millions of KEARNEY Fuse Links—far more than any other brand—have been protecting the power lines of America.

At KEARNEY we realize the thousands of dollars, the countless engineering hours put into compiling a coordination plan are soundly invested *only* when field performance matches published time-current curves. At the KEARNEY Substation Laboratory, *under actual field conditions*, extensive tests are carried out continuously so we can guarantee accuracy of performance . . . closeness of coordination.

KEARNEY has a *wider line* of Fuse Links, to meet a greater variety of conditions . . . all precision manufactured under quality controls. You can depend on KEARNEY.

KEARNEY Specialized and Standard Fuse Links . . . for accuracy, reliability

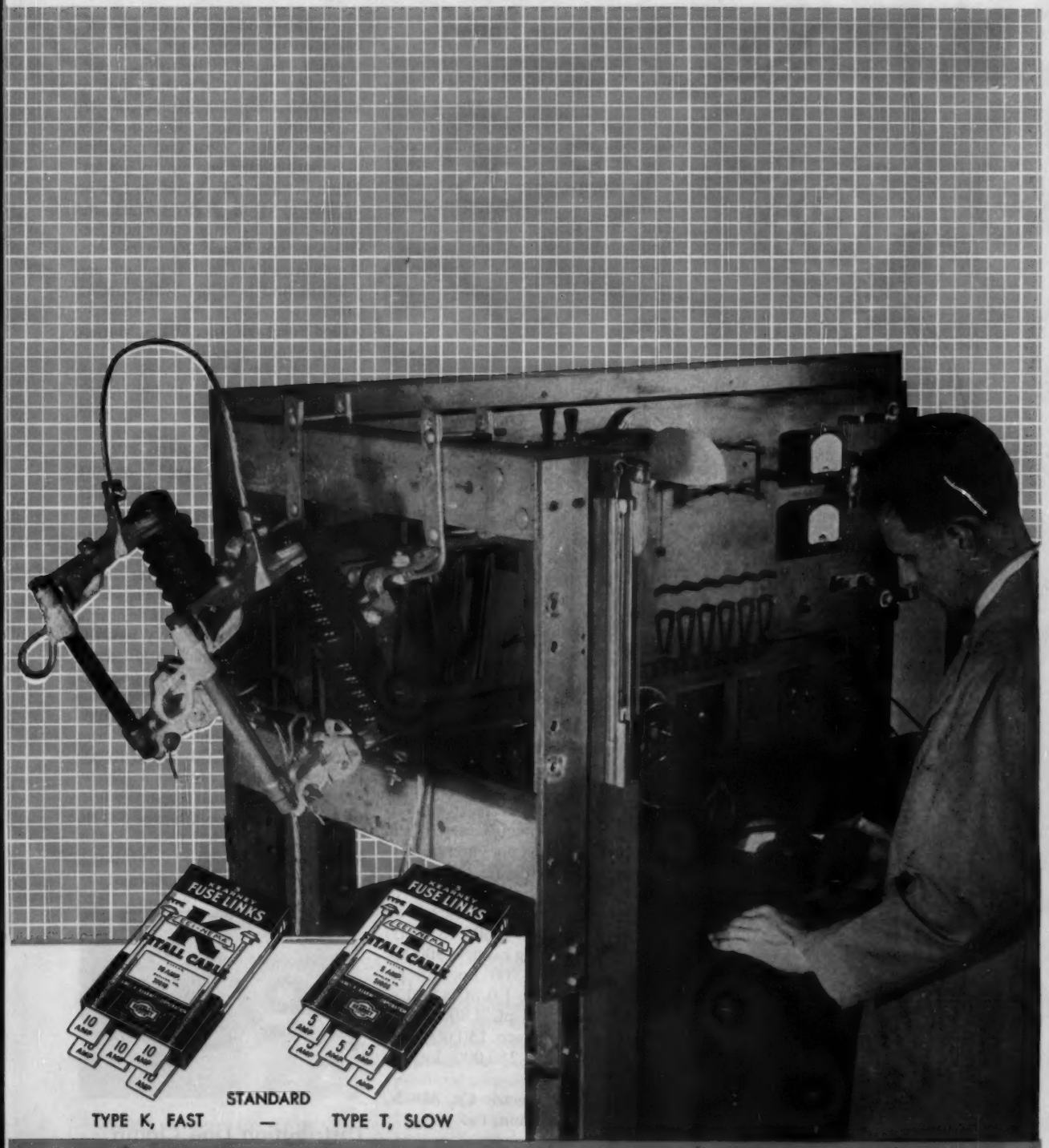
Fast Service! *Routine or emergency shipments from KEARNEY field warehouse near you will supply your needs in a matter of hours.*



SPECIALIZED TYPE KS SPECIALIZED TYPE 200 SPECIALIZED TYPE X SPECIALIZED TYPE QA

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Avenue, St. Louis 10, Missouri
Canadian Plant: Guelph, Ontario

JRK-341



STANDARD

TYPE K, FAST — TYPE T, SLOW

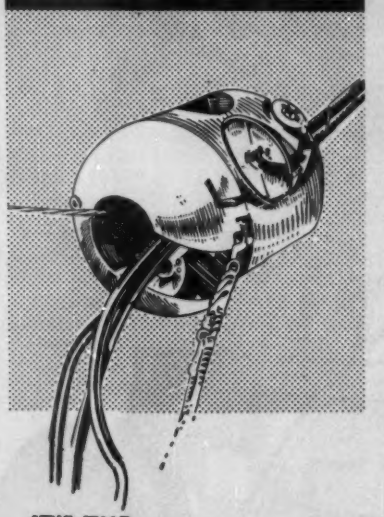
for BETTER CONSTRUCTION
SAFER MAINTENANCE

Specify KEARNEY

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

The Mark of Quality PRODUCTS

THREE TO ONE



IT'S THE
NEALE MODEL "K"
Only the
Model "K" Spinner
PLACES & SPINS
THREE SINGLE CABLES
Into
ONE COMPACT UNIT

ALSO SPINS SINGLE CABLE PERFECTLY

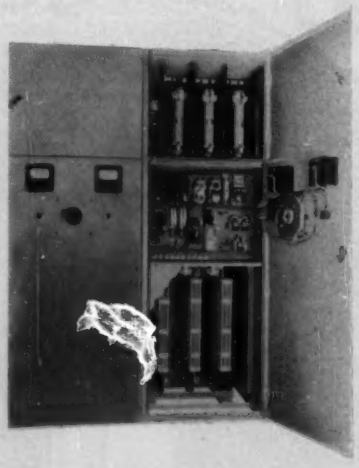
WRITE FOR LITERATURE AND PRICES

CABLE SPINNING EQUIPMENT CO.
3100 TOPEKA AVE.
TOPEKA KANSAS
Phone 2-7234
OVERSEAS SALES:
Ericsson Telephone Sales Corp. of New York
Automatic Electric of Canada
Pirelli of Great Britain

High Voltage Starters

A line of high voltage combination starters for squirrel-cage, wound rotor and synchronous motors is said to provide increased overload and short circuit protection.

Designated type FPA combination starters, they reportedly combine the advantages of current limiting high interrupting capacity fuses with rugged air break contactors. They also feature: completely steel-enclosed fuse compartment; individual fuse isolation by full depth phase barriers; removable contact barrier with assembly access from front or rear; and insured compartment separation through flanged door housings.



The starters are said to be suitable for control and protection of all types of 3-phase, 50-60-cycle ac motors operated at 2,300 to 4,800 v with the following ratings: 900 hp, 1.0 pf, 2,300 v; 700 hp, 0.8 pf, 2,300 v; 1,500 hp, 1.0 pf, 4,800 v; and 1,250 hp, 0.8 pf, 4,800 v. Interrupting ratings are 150,000 kva at 2,300 v and 250,000 kva at 4,160-4,600 v.

Federal Pacific Electric Co, 888 N. Keyser Ave, Scranton, Pa.

Silicate Modified Coating

A silicate modified coating, called "Profilm", is said to have the appearance of paint, is applied by conventional spray equipment, and will dry to the touch on most applications in a few minutes.

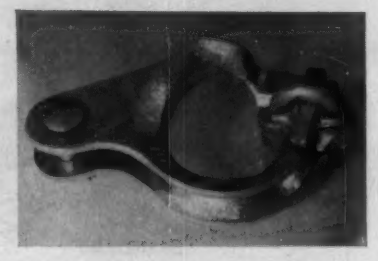
Profilm is designed for use where corrosive elements such as acids, alkalies, humidity, moisture, salt, etc., are a source of coating failure and excessive maintainence cost. It is available in colors and also comes in black, white, clear and metallics —in both baking and air-dry grades. Manufacturer claims Profilm can be applied to virtually any surface, including metal (ferrous and non-ferrous), masonry, wood, asbestos, etc. Applications are said to include appliances and pole hardware among others.

Allied Porcenell, Inc, 851 S. Market Street, Waukegan, Ill.

Weed Killer

Nalco H-174 is the name by which a new granular weed killer for industrial use is known. It is suggested for use around warehouses, oil and chemical storage tanks, lumber yards, power lines, loading docks and other areas where freedom from vegetation is desirable for reduced fire and safety hazards and better appearance. Applied directly from a shaker-type package or with a spreader; reportedly requires no power spraying equipment. Manufacturer states that normal dosage is 200 to 400 lb per acre.

National Aluminate Corp
6216 W. 66th Place, Chicago 38, Ill.



Distribution Line Clamp

This malleable iron line clamp has a type-keeper that reportedly can be reversed without completely removing the U-bolt. The reversing is done by backing off the nuts and reversing the keeper. The clamp has a range of from 0.2 to 0.5 in. and a rated strength of 10,000 lb. Designated No. 2051, it has been

designed for use with ACSR No. 4 through No. 1/0 conductors; it can also be used with copper, copperweld, and amerduct conductors. **Porcelain Products, Inc, Parkersburg, W. Va.**

More New Products

General Electric Co, Schenectady 5, N. Y., has developed a small **lamp ballast** for two F96T12 lamps at 430 ma.

Pannellit, Inc, Skokie, Ill., has a new **panel board material** made of laminated Formica and aluminum.

Pyle-National Co, 1334 N. Kostner Ave, Chicago, Ill., is selling a **commercial lighting fixture** called the "Multi-Vent Troffer" which "breathes" air and reportedly will cut air conditioning costs.

Lightolier, Inc, 346 Claremont Ave, Jersey City, N. J., has introduced two new products. They are (1) a recessed **fluorescent lighting form** called Strialux, designed for use with all types of 2 x 4 ft acoustical ceilings and plaster ceilings; and (2) a recessed dome incandescent lighting **fixture,** known as Quadrilite which combines direct downlight and diffused indirect light. It comes in a 2-ft square and a 33-in. round dome, both of which have an apparently free-floating, star-shaped centerpiece.

American Silver Co, 36-07 Prince Street, Flushing 54, N. Y., has available **copper tape** with thicknesses as low as 0.00015 in.

Indikon Co., Watertown, Mass., has packaged protective and **measuring systems** for pipe lines and other industrial applications.

Hobart Brothers Co, Troy, Ohio, has developed a tractor-type automatic submerged **arc welding unit** for operations involving long seams.

Motor-Mation, Inc, North Canton, Ohio, has introduced an automatic **commutator turning machine** (model CTM 2000) to its line of electric motor production equipment.

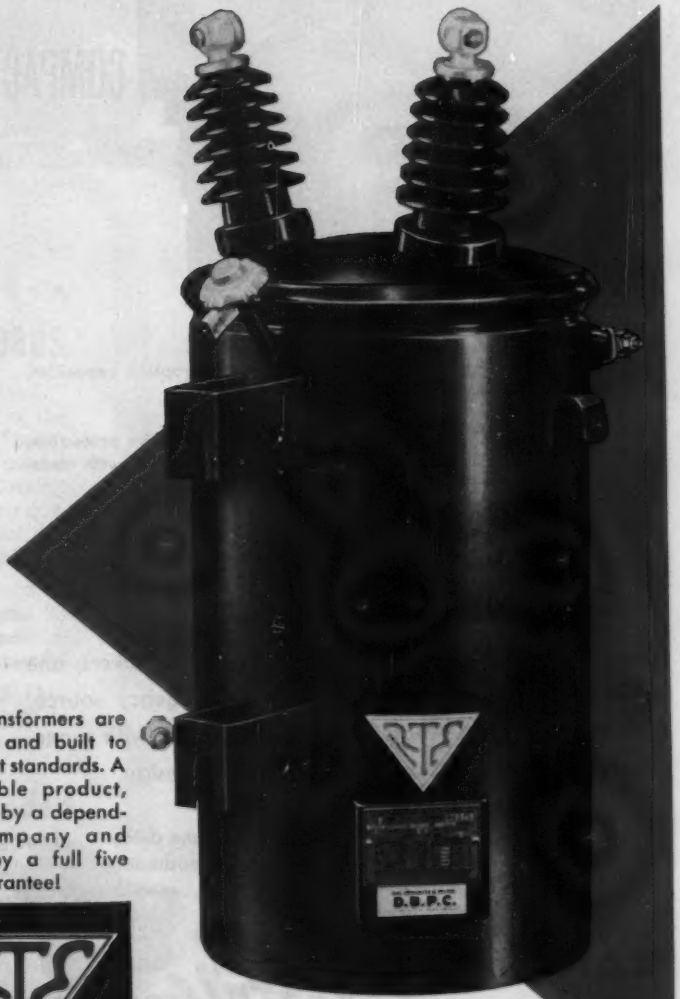
OUTSTANDING BASIC DESIGN

Easy to Install . . . Operate . . . Maintain . . .

What Makes RT&E Transformers Better?

Every RT&E Transformer combines the result of years of industry progress with the experience and creative thinking of RT&E Engineers.

The result is a transformer that is low on losses, regulation and weight — high in impulse strength and overload capacity. A transformer thoroughly tested for top performance.



RT&E Transformers are designed and built to the highest standards. A dependable product, produced by a dependable company and backed by a full five year guarantee!

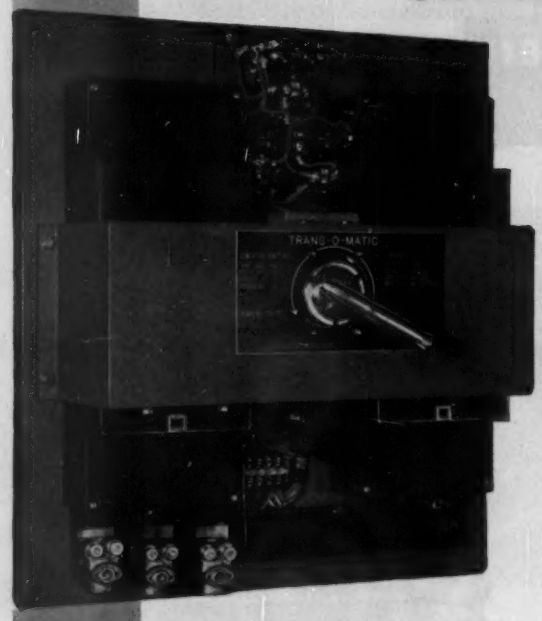
RT&E CORPORATION
WAUKESHA, WISCONSIN

OUTSTANDING BASIC DESIGN — *Another reason why* RT&E *is better!*

DOUBLE-THROW DUAL CIRCUIT BREAKER DESIGN

TRANS-O-MATIC

AUTOMATIC TRANSFER SWITCH



gives you

CAPACITY

SENSITIVITY

COMPACTNESS

- Full range to 50,000 amp. interruption capacities, 600 V. 800 A. loads.
- Complete failure two-wire or three-wire protection, or full relay 3 phase, 3 wire protection with transfer when any or all legs drop below 90%.
- About one half the size of similar equipment, suitable for switchboard, deadfront panel mounting, or separately in NEMA-Type closures.

Trans-O-Matic employs two standard circuit breakers; one from the normal and one from the emergency source. Either will carry the load. Mechanical linkage with supervisory relays are of double source control design.

OPTIONAL . . . adjustable time delay . . . engine starting contact . . . test pushbutton . . . pilot lights for switch position . . . special enclosures.

LAKE SHORE *Electric* **CORPORATION**
200 WILLIS AVENUE
BEDFORD, OHIO

TECHNICAL LITERATURE

NATIONAL ELECTRIC CODE—The 1956 Edition of the National Electric Code has been published by the NFPA. It is a revised edition of the 1953 Edition, and contains all interim amendments and additions since the publication of the earlier edition. New features include: tables on current-carrying capacity of aluminum conductors; grounding requirements for receptacles for lawn tools; spacing requirements for receptacles in dwellings; safety provisions for fluorescent lamps; transformer vault construction recommendations; and other information. 480 pages, $1.00 a copy. Write National Fire Protection Association, 60 Batterymarch Street, Boston 10, Mass.

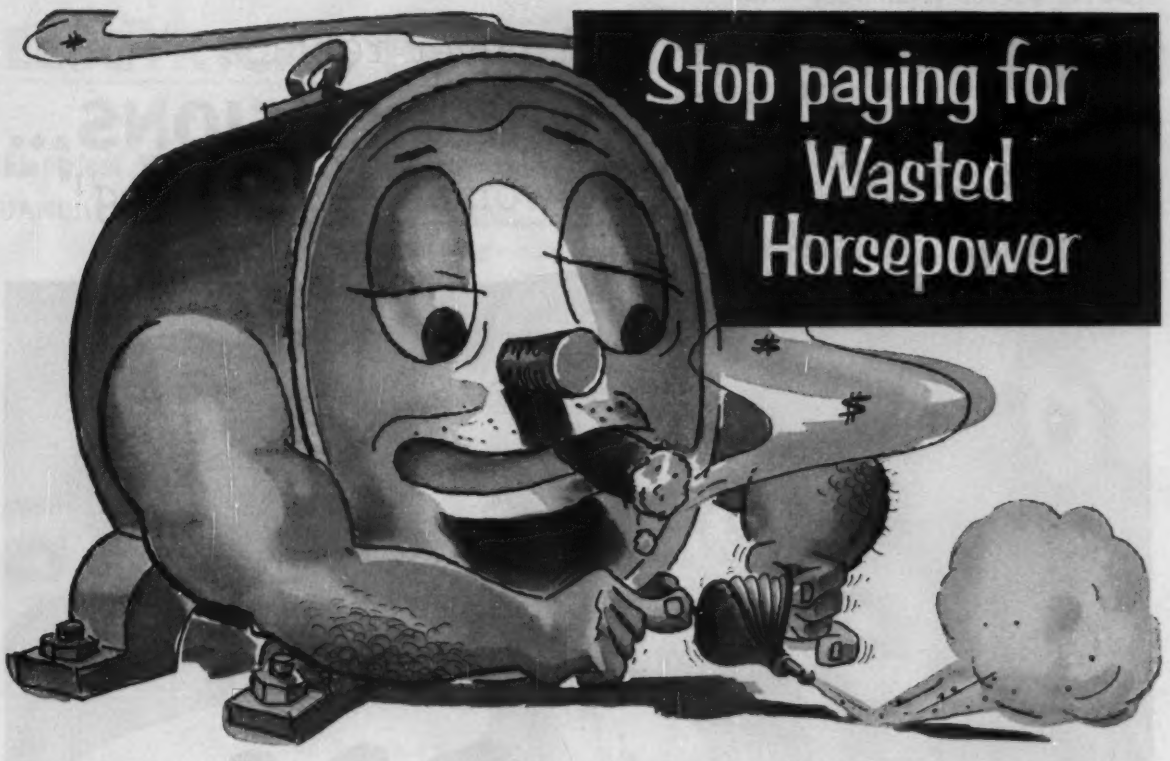
ASTM SYMPOSIA—American Society for Testing Materials has recently published two symposia: One on Speed of Testing Non-Metallic Materials, including those such as rubber and glass over a wide range of speed tests, 86 pages, $2.50 a copy; the second is on High-Purity Water Corrosion, which will be of interest to those concerned with high-purity water and its corrosive effects under various conditions, 56 pages, $1.75 a copy. American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

SPECIAL COPPER-ALLOYS—A tabulation of non-standard, wrought copper base alloys has been prepared by the Technical Committee, Copper & Brass Research Association. The list provides trade name, generic name, nominal composition, forms available, typical applications and mill source for each alloy. Free, Copper & Brass Association, 420 Lexington Ave, New York 17, N. Y.

TEMPERATURE COMPENSATOR—A table has been formulated to help cut short the task of applying temperature compensators in electrical circuits. It is said to save time and simplify compensator selection by reducing each problem to a sort of "building block", which then may be used in subsequent problems. The specific compensators concerned are GE's Thermistors. General Electric Co, Metallurgical Products Dept, Detroit 32, Mich.

SCHOOL LIGHTING—The relation between good school lighting and good learning is explored in a 24-page booklet entitled, "Common Sense in School Lighting." Obtainable from American Ass'n of School Administrators, 1201 16th St, NW, Washington 6, D. C. 50¢ a copy.

HIGH TEMPERATURE PIPING—The new superstrength alloys for main steam piping used on steam generating plants, the design of which are following the trend to higher temperatures and pressures, are discussed in a new ASME publication. The name of the paper is "Metallurgical Considerations of Main Steam Piping for High Temperature, High Pressure Service", by H. S. Blumberg. Three main aspects of the subject are covered: (1) The problem of behavior and selection of main steam piping materials; (2) Historical and technical background of the development of the materials currently used; and (3) Materials in the latest high-temperature, high-pressure stations designed to operate up to 1,200 F and 5,600 psi. American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y. Price is 25¢ to members and 50¢ to non-members.



Stop paying for Wasted Horsepower

Just match your average load . . . let silicones carry the overloads

If you specify horsepower to equal "peak overloads," your motors work at full rated capacity only part of the time — you're paying for unused horsepower. Today, silicone insulation has outmoded this kind of wasteful over-motoring. Motors insulated with Dow Corning Silicones have a service factor of 25 to 50% . . . so now you can merely match your average load, and let this *built-in* service factor handle intermittent overloads.

Lower your motor costs! For every dollar wasted on unused motor capacity, you spend an additional $3 for starters, cable, transformer capacity and installation. Silicone insulated motors *save* you real money!

Boost your production! Motors insulated with Dow Corning Silicones have much greater resistance to heat, moisture, and corrosive atmospheres . . . assure *more continuous production.*

Remember, over-motoring is outmoded

Get sources for silicone insulated equipment—mail coupon today

Here's more proof for you...

The Philip Sporn plant on the American Gas and Electric System installed its first silicone insulated motor over 6 years ago . . . a 1000 hp, 1190 rpm forced draft fan motor built by the Elliott Co. Smaller and less costly to install than an equivalent 1500 hp conventional motor, this unit has been operating in ambient temperatures up to 120 F without a sign of failure to date. Starting against cold air 4 times a day, it is overloaded by 30% bringing its total rise to 250 F with an output of 1300 hp. This kind of dependable performance has led American Gas and many other leading utilities to standardize on silicone insulated auxiliary motors.

Dow Corning Corporation, Dept. 4413, Midland, Mich.

Please send me sources for Silicone insulated
☐ Motor ☐ Transformers ☐ and Reprint
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"I'll never replace

VICTOR SUSPENSIONS...

I just won't live that long!"

Men who purchase insulators are enthusiastic about the service records of VICTOR Suspensions. That's because VICTOR Suspensions are laboratory designed, manufactured under rigid quality controls and tested with the industry's most modern equipment.

Take the No. 900 Insulator shown above, for example. It has rugged, rounded corrugations for maximum strength and resistance to impact. Cap and ball bolt are thick, husky and galvanized to withstand severe service. Scientifically fitted glaze gives added strength and added protection against contamination. Each insulator is proof-tested mechanically, then subjected to vigorous high frequency and 60-cycle flashover tests. When you buy VICTOR, you just can't buy better suspensions!

New . . . . . .

VICTOR CATALOG

Now ready for distribution is Victor's newest and most extensive catalog. One of the most complete in the field, it includes illustrations and data on many items being produced at VICTOR and not previously shown, up-to-date EEI-NEMA Standards, and an outline of VICTOR'S new plant, research, testing and manufacturing facilities. It's FREE! Write for *your* copy.

VICTOR INSULATORS DIVISION

I-T-E CIRCUIT BREAKER CO., INC.
VICTOR, N. Y.

ELECTRICAL BUSINESS OUTLOOK

Electrical World
JANUARY 14, 1957

Industry's plans are pretty firm to install a record amount of new plant and equipment this year. The latest McGraw-Hill survey (EW 12/17/56, p 60) indicates that plans on tap run around $40.2 billion. And this is likely to stick despite some stumbling blocks—namely, the continued tight money market, a sluggish profit showing for the third quarter of 1956, and the government's decision to cut off fast tax amortization benefits for expansion of the steel industry.

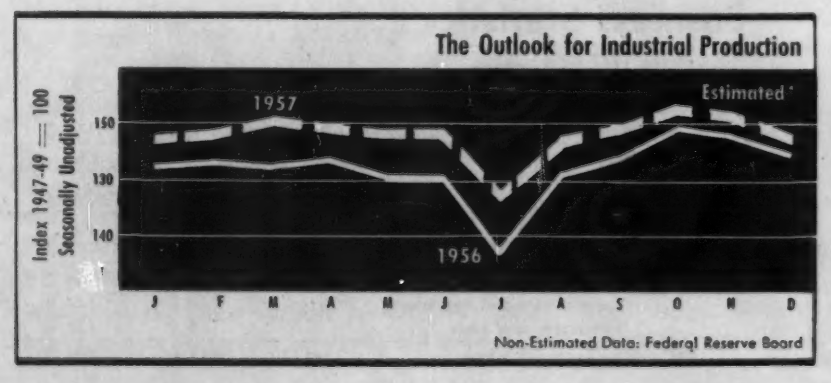
The government's tight money policy is likely to be with us well into 1957. Certainly right now there is no easing of the long-term market in sight. But it is reasonable to expect a temporary easing in availability of short-term funds. At this time of the year banks normally regain deposits following sharp Christmas withdrawals.

Even with money tight, industry will have to go ahead with most expansion to keep ahead of demand. Electric utilities are a case in point. They feel the effect of the policy more directly than other industries because they depend less on retained earnings to finance expansion. Their budgets for capital expenditures will be 30% above 1956. Steel is in a similar position, but because of faster capital turnover is in a better position to generate internal funds for expansion.

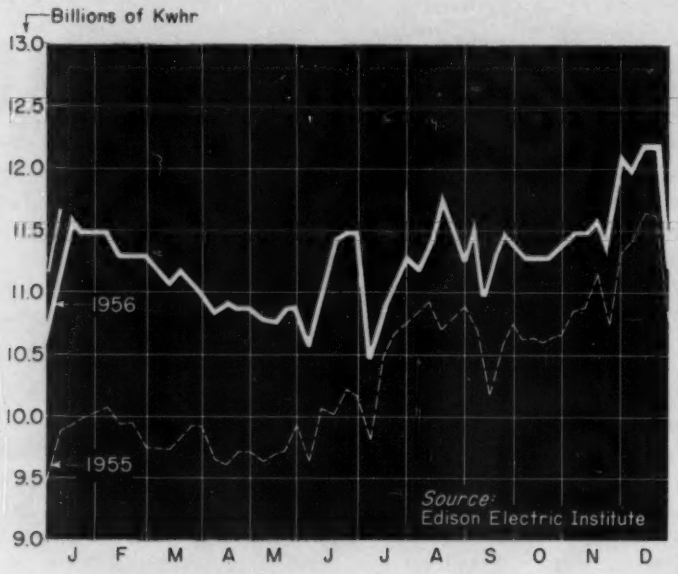
Nor is a temporary dip in profits enough to deter capital investment plans. McGraw-Hill surveys have shown that well over half of all business firms plan investment at least two years in advance. So the weak profit showing for the third quarter of 1956 is not likely to touch off a rash of cancellations. And even with the weak third quarter, 1956 was almost certain to push up profits close to the 1955 level.

The 1957 profits picture is likely to reflect the 1956 situation: a lot more business but relatively slight gains in profit. In 1956 GNP advanced over $20 billion; profits scarcely changed. Businessmen this year, too, are likely to record big sales gains but with little or no improvement in profit margins.

Pulling the fast tax amortization props from steel expansion is a temporary setback at most. Backlog of orders today indicates that present capacity is inadequate to satisfy both peacetime business needs and defense build-up. In the face of continued strong demand, it is unlikely the steel industry will drop expansion plans. But it may take both higher prices and more security issues to finance additional capacity.



STATISTICS



OUTPUT

Week ended Jan. 5,
11,671,000,000 Kwhr
Up 5.6%

Per Cent Change From Previous Year

	Dec. 22	Dec.29	Jan. 5
Total U. S.	+ 5.3	+4.1	+5.6
New Eng.	+ 1.9	+2.3	+3.9
Mid Atlantic	+ 1.4	+0.9	+2.7
Cent. Ind.	+ 5.3	+3.9	+4.8
West Cent.	+ 7.6	+6.0	+7.3
Southeast	+ 4.5	+2.7	+5.0
South Cent.	+12.7	+9.4	+9.6
Rocky Mount.	+ 7.2	+9.5	+9.4
Pacific			
NW	+ 2.7	+6.6	+6.4
SW	+10.8	+6.6	+9.9

Seasonally Adjusted Index 222.6
Week Ago 221.8
Year Ago 212.6

Atomic Energy Commission requirements—1,150,000,000 kwhr.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Oct.	119.38	118.66	112.13	6.5
Peak—Class 1 Systems. million kw	Oct.	96.6	96.5	90.7	6.5
Estimated Dec. '56 Peak	Oct.	106.20	106.17	104.34	1.8
Production—billion kwhr	Oct.	51.13	48.82	47.70	7.9
Hydro		9.24	8.96	8.80	4.9
Fuel		41.89	39.86	38.60	8.5
Sales—billion kwhr	Oct.	45.98	46.07	43.06	6.8
Residential		11.27	11.68	10.38	8.6
Commercial		7.37	7.82	6.88	7.1
Industrial		24.79	23.86	23.34	6.2
Other		2.56	2.72	2.45	4.5
Fuel Consumption	Oct.				
Coal—million tons		13.52	12.45	12.65	6.9
Oil—million barrels		6.27	5.20	6.04	3.8
Gas—million cu ft		114.36	124.63	104.80	9.1
Net Income Class A & B Co's—$ million	Oct.	95.79	108.45	94.61	1.2
Residential Customers—millions	12 mos.	45.49	45.39	44.21	2.9
Revenue per kwhr	ended	2.60¢	2.61¢	2.65¢	−1.9
Avg kwhr per customer	Oct. 31	2,942	2,929	2,715	8.4
Avg annual bill		$76.49	$76.45	$71.95	6.3

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Nov.	149	150	144	3.5
ENR Construction Cost	Jan.	148.4	147.6	141.8	4.7
BLS Cost-of-living	Nov.	117.8	117.7	115.0	2.4
New Orders for Machinery (1950 = 100)	Nov.	140	139	143	−2.1
NEMA Sales					
Insulation materials	Oct.	170	147	156	9.0
Electric appliances		94	101	96	−2.1
Wholesale prices	Oct.				
Motors and generators		136.9	136.2	125.3	9.3
Transformers and regulators		144.8	144.8	129.2	12.1
Switchgear and fuses		161.9	157.0	146.3	10.7
GNP—annual rate—$ billion	3rd Qtr.	413.8	408.3	396.8	4.3

MANAGEMENT BULLETIN

FINANCE

Electric company security offerings went into high gear last week. This will help to provide the new year's test of the "tight money" situation. First Boston Corp group offered 200,000 shares of Illinois Power Co common stock at $56.375 to yield 5.32%. It is reported "oversubscribed." . . . Salomon Bros. & Hutzler, Eastman Dillon, Union Securities group won $20 million Idaho Power Co first mtge 4½% bonds (Aa) due 1987 at 99.107%; reoffered at par to yield 4.50%. The bonds were "well received." For additional reports on latest financing see p 19.

A saving of more than $1,000 has been accomplished by the Whatcom County Public Utility District when it bought back $47,000 of its bonds. A block of 37 bonds was recently acquired at $970 for each $1,000 bond, plus accrued interest of $169. PUD sold some $50,000 of 2⅞% U.S. Treasury notes to pay for the bond retirement.

Higher quarterly common stock dividends are announced. Consumers Power Co will pay 60¢ a share as compared with 55¢ previously . . . Delaware Power & Light Co has upped its dividend to 45¢ a share versus 40¢ in the previous quarter.

"A Tabulation of Electric and Gas Utility Co Common Stocks" booklet showing 1956 earnings, market prices, etc, has just been issued by First Boston Corp. For copy, write George L. Perin, vice president, 100 Broadway, New York 5.

Public Service Co of Colorado has received PUC approval to purchase the Carbondale Light & Power Co for $130,000 . . . Pudget Sound Power & Light Co has bought the system of Northwestern Improvement Co, serving Roslyn, Cle Elum, and Ronald, Wash., for an undisclosed amount. Bid of the Kittitas County PUD was rejected . . . Alabama PSC has set a "fair price" of $750,000 for Alabama Power Co's properties in Ozark. Alpoco's Executive Vice President Walter Bouldin told the PSC that "the price to be fixed by the commission should be not less than $4 million."

REGULATION

Niagara Mohawk Power Corp asks New York PSC for $7,077,000 a year electric rate hike. It will affect 525 customers who use 25-cycle power. This readjustment is a result of the collapse of Schoellkopf hydro plant at Niagara Falls in June which resulted in loss of substantial 25-cycle generating capacity. This made it necessary for Niagara Mohawk to import 25-cycle power from Canada, at a higher cost, and make other arrangements to see that this power supply was adequate. Industries in both Buffalo and Niagara Falls have organized to fight the increase.

New rules of practice and procedure for the regulation of electric, natural gas, telephone, and water companies have been put into effect by the Mississippi Public Service Comission.

Mexican Light & Power Co has received a 12.49% electric rate increase. Company had requested a 30% increase.

PUBLIC RELATIONS

More than 8,000 wires, letters, and postcards have been received by Consolidated Edison Co of New York praising the company for its public service in sponsoring a nine-hour TV show on a recent United Nations Meeting. It was called in connection with the Suez crisis by the UN General Assembly and was the first emergency special session in its 11-year history. Using a split screen, John Tillman, announcer of the TV station, appeared occasionally stating that it was being made available through the cooperation of Con Ed.

What does the terms "private power" and "public power" mean. Western Massachusetts Companies have put out a booklet which summarizes these terms

and suggests principles for the formulation of a national power policy. For copy, write Howard J. Cadwell, president, 201 Devonshire Street, Boston, Mass.

LABOR **Why nearly 60,000 members of the nation's 500,000 engineers have unionized** is subject of a study just completed by the National Industrial Conference Board. One of the chief financial complaints of engineers, the study reveals, is that the earnings differential between salaried engineers and wage earners has become too narrow in many companies. And in terms of fringe benefits, engineers say their former advantage over the production worker has been virtually wiped out. Second major financial complaint is that existing salaries for engineers have not kept pace with increases in the hiring salaries of engineers.

Gordon M. Freeman, president, International Brotherhood of Electrical Workers, will address the American Power Conference luncheon on Friday, March 29. His subject will be "Labor's Stake in Our Free Enterprise System."

Tennessee Valley Authority has made wage increases of 5¢ to 22½¢ an hour to its 8,000 hourly paid workers. They averaged 5.36%, and ranged from 5¢ per hour for plasterers to 22½¢ for bricklayers, who remain the highest paid craftsmen at $3.50 an hour. TVA said journeymen employed on an annual basis got increases averaging $300 a year, laborers, $210.

YOUR HEALTH

Cancer of the Bowel

REX H. WILSON, MD, Medical Director, The B. F. Goodrich Co

He had noticed streaks of red blood in his bowel movements for several months. Then he began to have a feeling of discomfort in his left upper abdomen and he felt as if his bowel movements were being constricted. X-rays showed a mass in the left colon. At surgery a large carcinoma was removed. All visible cancer tissue was removed. Probably the cancer will continue to spread and will, in about eight to ten months, cause his death.

The possibility of a cancer should be considered in every person with digestive or bowel symptoms. Any change in the bowel habit is a warning signal.

Bowel cancer is more common in men. Over 50% of bowel cancers occur in the rectum. Many of the cancers of the bowel are slow in their growth, and spread (metastasize) late.

There are no characteristic symptoms of cancers of the bowel. They vary according to their location. One patient may complain of a persistent diarrhea, another of constipation. Bleeding from the rectum is a fairly common symptom. A frank hemorrhage of blood is rare but may occur. There may be a vague abdominal discomfort or mild cramp-like pains. Signs of obstruction of the colon (constipation, gaseous distention and vomiting) occur late in the disease.

Loss of appetite, weight loss and the feeling of a mass in the abdomen are late symptoms. Cancer of the bowel spreads to the nearby organs. Fluid in the abdomen may result from the spread.

Frequently during X-ray examinations of the bowel, polyps are found. These are tit-like growths in the bowel. The growths should always be removed as soon as possible because they are often pre-cancerous.

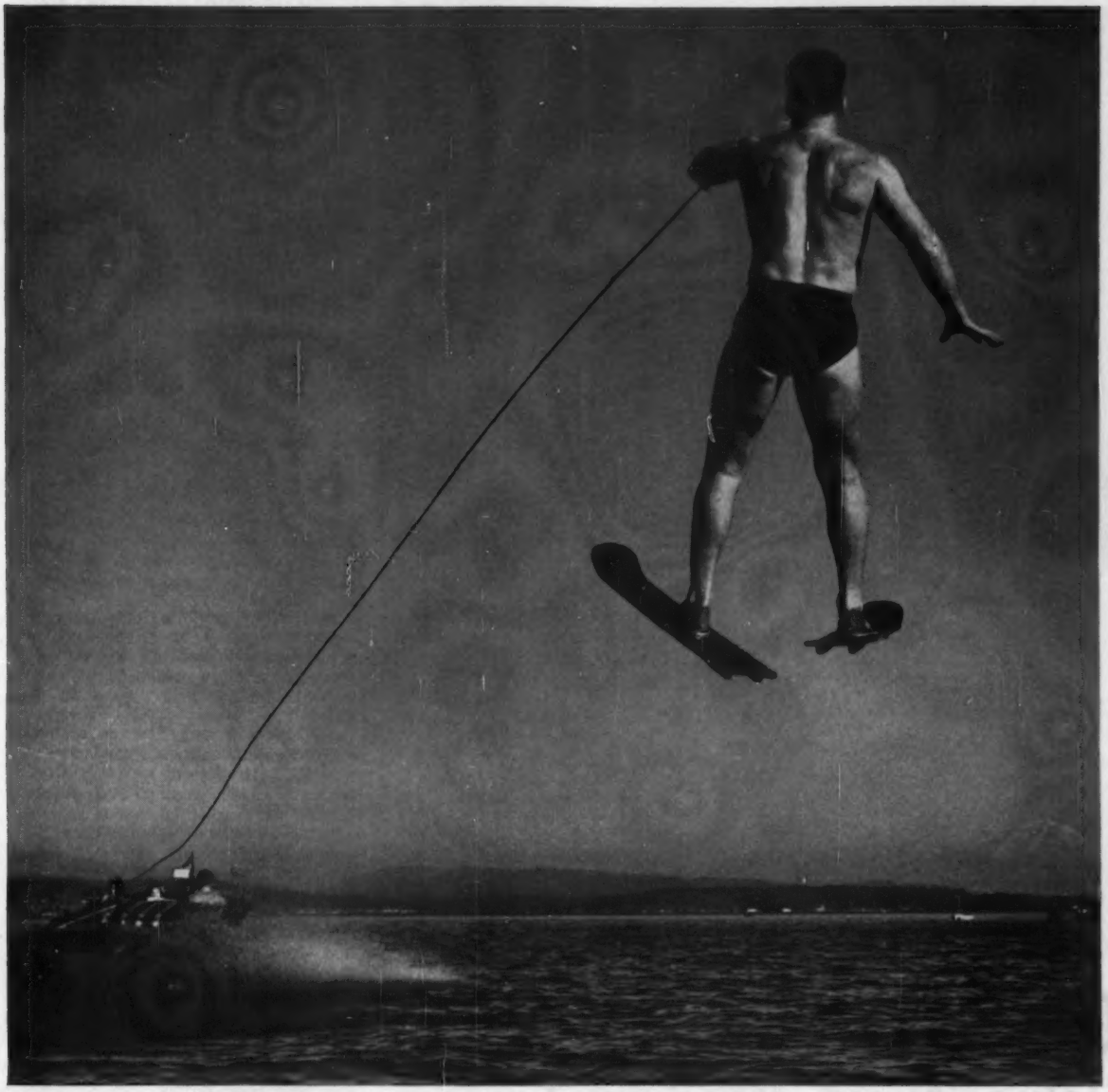
The only effective treatment for any growth in the bowel is to remove it. Any suspicious cancer-like tissue about the growth should be removed.

Many patients who have had a cancer of the bowel make a complete cure. A cure is considered to be effected only when the patient lives five years after his tumor is removed. Cancers of the rectum require total removal of the rectum and the creating of a permanent colostomy (bowel opening) in the abdominal wall.

Everyone should have a periodic physical examination. Any significant change in bowel habits should be investigated. Many cancers are found on routine X-ray examinations.

Cancer can be cured, but only if it is found early and removed. Usually symptoms of cancer of the bowel occur early enough to alert the individual that something is wrong. When a mass can be felt you probably have ignored many months of warning signs.

Medical research is progressing well along the road to finding the cause of cancer. There is some progress toward finding simple detection tests for the disease. But they are not here yet. Our only hope is to have the cancer found early and removed. For the physician to do this he must have one thing —YOU!!



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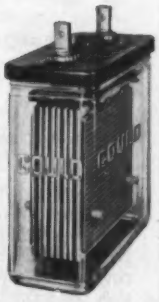
Consider why other people buy Gould Batteries:



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2/3 ACTUAL SIZE

Shows one scale at a time

G-E Hook-on Volt-ammeter Helps Avoid Reading Errors

RANGE AND SCALE of this G-E instrument show simultaneously by simply turning the fingertip control knob. Seeing only one range and scale avoids reading errors.

SCREW-IN VOLTAGE LEADS and recessed terminals provide maximum protection for the operator. Voltage leads cannot be pulled out accidentally.

WIDE RANGES ARE AVAILABLE in both models of the G-E hook-on volt-ammeter. Ranges of the AK-4 model are 0-10/30/100/300/800 amperes and 0-150/300/750 volts. The AK-5 ranges are 0-5/20/80/350 amperes and 0-150/300/750 volts. The wider range AK-4 model has a pointer-stop for accurate checking of surge readings.

FOR FURTHER INFORMATION, write Section 582-11, General Electric Co., Schenectady 5, New York and ask for bulletin GEA-6292, or contact your nearest G-E Apparatus Sales Office or Distributor.

GENERAL ELECTRIC

BOOKS

Received Since December 10

Introduction to Electrical Engineering—3rd Edition. By George V. Mueller. Published by McGraw-Hill Book Co, Inc. 330 W. 42nd St, New York 36, N. Y. 466 pages, illustrated. Price $7.50.

Electronic Computers. By T. E. Ivall. Published by Philosophical Library, Inc. 15 East 40th St, New York 16, N. Y. 167 pages, illustrated. Price $10.00.

Reference Data for Radio Engineers. Published by International Telephone and Telegraph Corp, 67 Broad Street, New York 4, N. Y. 1121 pages, illustrated. Price $6.00.

How to Control Stock

Scientific Inventory Control, by W. Evert Welch. Published by Management Publishing Corp, 22 West Putnam Ave., Greenwich, Conn. 158 pages with index, illustrated. Price $12.50.

Scientific Inventory Control plunges directly into the heart of the inventory problem—how much to buy (or make) and when to buy (or make) it. It is not a textbook or a theoretical study. Instead it contains what is obviously a composite of inventory control schemes and formulas now being used successfully. This is born out by the fact that the author is Director of Procurement for the Aeronautical Division of Minneapolis-Honeywell Regulator Co.

The book contains guides on the "how to" of establishing safety margins to avoid "out of stock". The "how do" also includes: (1) evaluating the quality of lead-time data, (2) computing order quantities when usage is variable, (3) handling quantity discounts, (4) making a scientific inventory study.

Scientific Inventory Control is an interestingly practical approach to an age old problem. It has been written for men who must do the job—including utility purchasing agents and stores managers.

Code Changes

Analysis of 1956 Revision of National Electrical Code. By H. P. Michener. Published by National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N. Y. 45 pages, paper bound. Price $0.25.

Every utility engineer will benefit from study of this pamphlet which points out and explains changes in the National Electrical Code since the 1953 revision. Written for use in conjunction with the new 1956 Code, it draws upon panel reports and other sources to clarify some revisions where the reasoning is not clearly presented by the Code itself.

SALES ASSIGNMENTS

COMPANY STAFFS

Allis-Chalmers Manufacturing Co's Industries Group has appointed John H. Gerber as service manager of its North Central Region . . . Ralph L. Haney is new manager of the recently opened Allentown, Pa., branch office of Industries Group's Philadelphia district . . . Newly appointed at the Los Angeles district of the Industries Group were T. R. Bluemle, to manager, industrial sales; A. W. Leighton, manager, utility sales; and D. E. Steele, manager, petroleum and chemical sales . . . G. K. Lewis has been designated manager of utility sales and Alan Purchase as manager of industrial sales in the San Francisco district office.

Bailey Meter Co's George D. Williams has been named manager of the Boston district office to succeed P. T. Reuter who died recently.

Bristol Co has appointed John E. Kearns manager of its new district sales office at San Francisco.

A. B. Chance Co has designated Frank C. Voelker as manager of its new region, which includes Michigan, Indiana, Kentucky, Ohio, the western half of Pennsylvania, and parts of Virginia and West Virginia.

Clark Bros Co recently named William T. Durkin as manager of its Pittsburgh office. His territory comprises parts of Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia, West Virginia, and the provinces of Ontario and Quebec, Canada.

Day-Brite Lighting, Inc, has announced the appointments of Charles L. Amick as manager, sales department, and Brooks Chassaing as midwestern regional sales manager.

Dossert Manufacturing Corp has appointed C. D. Arnold as representative in Indiana, with headquarters in Indianapolis.

Enjay Co, Inc, has named J. P. Haworth manager of its newly established Eastern Sales Division, which comprises a 19-state area including New England, the eastern seaboard states, West Virginia, Ohio, and Michigan. H. C. Evans is new Akron district manager.

Four Wheel Drive Auto Co's new district sales managers are Lynn F. Perrott and Virgil Phelps. Perrott replaces Robert J. Peterson, recently named an assistant sales manager, as district sales manager for Washington, Oregon, Idaho, Alaska, and British Columbia. Phelps will assume responsibility for Ohio, Kentucky, West Virginia, and portions of Pennsylvania and New York.

Gould-National Batteries, Inc, has named Carson I. Simms as manager of utility sales for its Industrial Division.

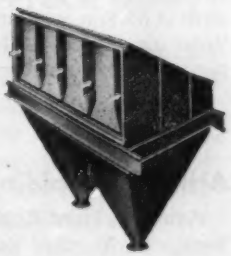
. . . . must be safeguarded against contamination. Every public-spirited industrialist realizes the importance of clean air to community good will, plant employee relations and the safety of his plant and its equipment.

Prat-Daniel has made notable contributions, during thirty years of research and manufacture, to the dust and smoke abatement programs across the nation. By promoting good public relations and protecting sensitive machinery, P-D Collectors have performed an outstanding service.

One of the many developments that have contributed to this success is an exclusive, patented, unique design of internal gas flow, known as *PLENAFLO. This feature eliminates recirculation, reduces wear, provides accessibility to every tube and improves efficiency.

The Thermix Corporation, Project Engineers, will be glad to send you a bulletin fully explaining this new idea in tubular design. Ask for Bulletin on P-D dust collectors featuring PLENAFLO.

*Trademark



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SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks

NEMA Predicts $21.5 Billion Shipments

The electrical manufacturing industry will turn out $21.5 billion worth of electrical products of all kinds, in 1957, predicted Joseph F. Miller, managing director, and A. J. Nesti, chief statistician, of the National Electrical Manufacturers Association, New York.

All branches of the electrical industry are expected to join in this record performance with increases in sales ranging from 5 to 15%.

Accompanying table, prepared by NEMA Statistical Dept, lists the various industry products and industry shipments for three years.

Some highlights are: Output of appliances, including radio and television, will pass the $5 billion mark; shipments of electrical industrial apparatus will be over $3 billion; insulated wire and cable, also generation, transmission and distribution equipment will each, for the first time, register more than $2 billion; signal and communication equipment add up to approximately $1.5 billion; illuminating equipment almost $1 billion; and a heterogeneous group of products ranging from electronic components and x-ray apparatus to batteries and hearing aids will account for $5.5 billion of the industrys' output in 1957.

Total Industry Shipments Electrical Manufacturing Industry

(All data in Millions of Dollars. Includes Exports and Interplant Transfers.)

Electrical Products	1955	1956	1957 Est
Appliances	$4,675.8	$4,800.0	$5,150.0
Illuminating Equipment	737.8	830.0	913.0
Signal and Communication Equipment	1,260.0	1,260.0	1,450.0
Industrial Apparatus	2,432.6	2,919.0	3,210.0
Building Equipment and Supplies	590.1	680.0	730.0
Insulating Materials	334.2	401.0	440.0
Insulated Wire and Cable	1,483.0	1,925.0	2,020.0
Generation, Transmission and Distribution Equipment	1,630.0	1,800.0	2,070.0
Other Electrical Products	4,441.0	5,000.0	5,500.0
Total	$17,584.5	$19,615.0	$21,483.0

American Blower Delivers Tampa's Big Compressors

American Blower Corp, Detroit, has shipped the third large capacity centrifugal compressor of a four-unit group to Tampa Electric Co, Tampa, Fla. This group is to be used in furnishing air for a cyclone fired boiler at a new power station. The manufacturer notes an indication of a trend in power plant operation toward higher duty and air supply requirements.

These compressors incorporate 48-in. intake and discharge connections. Each is driven by a weather-protected 1,000-hp, 1,800-rpm squirrel cage induction motor. The 48-in. unit is rated for air delivery of 325,000 lb per hr (or 78,200 cfrn) at 65.5-in. w. g. static pressure. Total air capacity is 1.3 million lb per hr for the four compressors.

AHR Buys Molding Firm

American Hard Rubber Co, New York, N. Y., has purchased the entire capital stock of Electric Manufacturing Co (Inc.) of San Francisco. Electric is a manufacturer of multi-color plastic moldings. E. L. Danielson, president, and Floyd Dofsen, vice president, of Electric will continue in their present capacities and will manage the business.

Capacitor Kvar Increased to 4.05 Million During 1956

Installed capacitor kilovars in the United States increased 6 million to a total of 40.5 million during 1956, reports W. G. Hart, manager of power capacitor sales for General Electric's capacitor department.

The ratio of installed capacitor kvar to peak load kilowatts was 0.35 at the end of 1956.

Hart commented on the continued trend on the part of many utilities to push their system power factors toward unity. Many utilities are finding it economical to operate their systems at power factors 98% and higher at the time of their system peaks. Peak efficiency, optimum use of facilities and reduction of power production costs have been the chief benefits of this trend.

Hart also pointed out these significant accomplishments made by the capacitor industry during 1956.

1. Acceptance by utilities of the more economical 50-kva capacitor (EW, Jan. 23, 1956, p. 241) which during the year became standard.

2. Development of a protective gap for series capacitors used with distribution transformers which may bring about greatly increased applications of series capacitors (EW, Nov. 19, 1956, p 59).

S. Morgan Smith to Furnish Turbine, Valves to PG&E

S. Morgan Smith Co, York, Pa., will manufacture hydraulic equipment valued over $1.25 million for Pacific Gas & Electric Co. The equipment is destined for two of the utility's major hydraulic projects—Kings River Development near Fresno, Calif., and Upper Feather River project in northern California. A turbine unit and 13 valves of various types are involved. Shipment is schedule to begin in the early summer of 1957 and continue until August of 1958.

The first project will have valves ranging in size from a 48-in. Howell-Bunger for free discharge to a 126-in. SMS butterfly for the upper end of a penstock.

Latter project will have a 111-in.

Smith-Francis turbine rated 52,000 hp, 200 rpm at 280-ft net head, also several valves—a 64-in. for pressure relief, a 78-in. for diversion branch of tunnel, a 144-in. butterfly for upper end of penstock, and a 132-in. butterfly for turbine inlet.

Westinghouse to Supply Anaconda Hoist Equipment

Anaconda Co has selected Westinghouse Electric Corp to furnish the electrical equipment for two mine hoists at Anaconda's Ryan Shaft in Butte, Montana. Shaft sinking operations are expected to begin early this year. Hoist installation is scheduled for completion in the fourth quarter of 1957.

Each hoist will have two 3,000-hp, 600-v, 500-rpm dc motors capable of operating at 225% occasionally applied load. The two motors will be powered by a 5,000 kw 600-v, 514-rpm motor-generator set. This set will have two 2,500-kw generators driven by a 7,000 hp, 2,300-v synchronous motor with 250% pull-out torque.

McGraw Electric Merges with Thomas A. Edison, Inc.

McGraw-Edison Co has been formed by merger of McGraw Electric Co, Elgin, Ill., and Thomas A. Edison, Inc., West Orange, N. J. The merger was approved by shareholders of both companies.

Former Thomas A. Edison Industries becomes a division of the new organization.

Officers of the new company are: Charles Edison, chairman of the board, and Max McGraw, president and chief executive officer.

Allegheny Ludlum Reports Electrical Steel Use Up 5%

Allegheny Ludlum Steel Corp, Pittsburg, Pa., enjoyed a 5% production increase over 1955's 791,000 net tons of electrical steels, reports E. J. Hanley, president. The year 1956 was an all-time high production year and 1957 is expected to have even greater tonnages. Growth of the use of these steels is said to parallel the growth of the use of electricity in the nation.

Hanley noted that cold-rolled stripped steel shipments to the electrical machinery industry rose 133%, to the aircraft industry 58%, and to industrial machinery and capital equipment shipments increased 43%. But the over-all shipments decreased 22%. Much of this product goes to the automotive industry, which had a 26% drop in shipments during 1956.

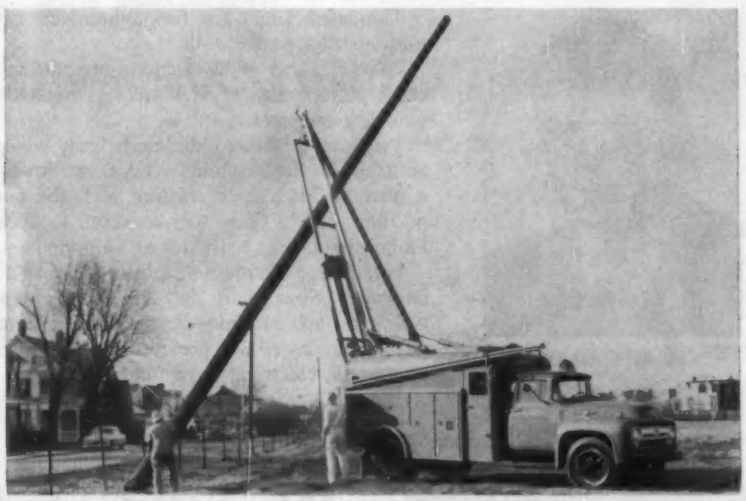
M&M BRIEFS

Permacel Tape Co, New Brunswick, N. J., has established an Electrical Products Sales Division which will be under the direction of Norman Hickok. Products are pressure sensitive and heat curing tapes for insulation, also epoxy resins, slot insulations and Teflon films.

Chase Brass & Copper Co has moved its New York office and warehouse business to its own new building of 73,000 sq ft at 55-60 58th Street, Maspeth, Long Island.

General Electric Supply Co's headquarters will be transferred, effective February 1, to Louisville, Ky., from Bridgeport, Conn.

Hamilton Watch Co, Lancaster, Pa., has introduced reportedly the first electric wrist watch. It has a replaceable button-size Energizer (similar to a battery) energizing a coil on the balance wheel which interacts with permanent magnets. Accuracy is said to be more than 99.995%.



York-Hoover to Market Line Truck Body

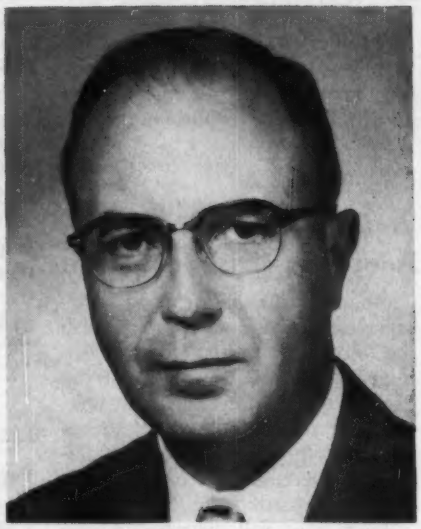
York-Hoover Corp, truck body manufacture of York, Pa., is reportedly about to market an all-steel unit that carries equipment and facilities necessary to build transmission, distribution and telephone lines.

According to Charles I. Ziegler, vice president, the new unit can set a 55-ft pole with its 29-ft derrick. The derrick's lifting capacity is limited only by the stability of the truck chassis. Other features include: self-storing hydraulic derrick support jacks; hydraulic digger carried and stored with derrick; a 20,000-lb capacity drum winch with hydraulic auxiliary drive controlled from the rear of the truck and mechanical drive controlled from the cab; and a 3-kw ac generator driven by the truck engine.

The truck body with accessories is arranged for mounting on a chassis ordinarily furnished by the customer.

NEWS ABOUT PEOPLE

Iowa Southern VP's Parks



C. EVANS PARKS

C. Evan Parks has been named vice president of Iowa Southern Utilities Co.

Formerly assistant to the president, Parks will be in charge of engineering, construction and operations for the company in his new capacity.

He joined Iowa Southern Utilities Co in 1955 as assistant to the executive vice president. Previous to this post, Parks served for over 20 years on the engineering staff of the Public Service Co of Indiana.

Parks started with the Indiana Co immediately after receiving his degree in electrical engineering from Purdue University in 1933. He assumed his new post on January 1.

Duquesne Light Co Promotes Gray and Gue

JOHN E. GRAY

Duquesne Light Co has announced two promotions this past month.

John E. Gray is new general superintendent of construction. Edwin M. Gue was named system planning engineer.

Previous to this appointment Gray was project manager for the Shippingport Atomic Power Plant, a post he held since starting with the company in June, 1954. Gray will continue to coordinate Duquesne Light's activities at Shippingport.

Gue joined Duquesne Light in 1937 as a design engineer. Since that date he has held various positions such as senior design engineer, electrical station engineer, and previous to his present appointment, electrical design engineer.

EDWIN M. GUE

Warren Gets New Post at GE

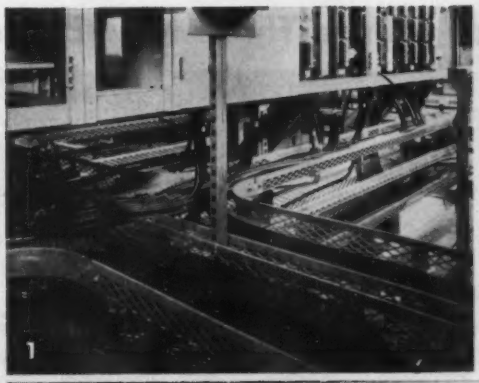
Glenn B. Warren, vice president of the General Electric Co, has been appointed consulting engineer—Turbine Division.

In his newly-created post, effective January 1, Warren will devote full time to accelerating the technical progress of industry's basic power unit, the turbine-generator. He will be responsible for formulating and establishing long-range engineering and product plans for all departments of the company's Turbine Division, as well as for conducting a continuous audit of all related engineering activities.

Warren received his BS in mechanical engineering at the University of Wisconsin in 1919 and joined the General Electric Co that same year on the engineering test program.

William S. Ginn assumes Warren's former duties (see EW, Dec. 31, p 40.)

GLENN B. WARREN



1 Smaller Diameters and light weight of RoMarine-RoPrene make it your best choice for trays, racks, and other metal race-way installations.

2 Easy To Pull, Rome Power distribution cable slips quickly into manholes and through conduit or duct runs.

3 Ideal For Underground applications, this Rome cable resists the corrosive effects of burial.

Underground, in ducts, and overhead . . .

Rome's power distribution cable helps you cut costs three ways

When you install RoMarine-RoPrene cable instead of a cable with metallic covering, you can save money three ways:

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- **Reduced inventory levels**

Extremely versatile and tough, RoMarine-RoPrene cable can be buried directly in earth, installed in ducts or conduits, or hung overhead on poles. No longer must you stock three different kinds of 600-volt cable. And easier termination and splicing will provide further economies—every 30-minute saving is worth more than $2.00 to you!

Long service life also assured

Besides economy, you get real dependability from this versatile and rugged Rome cable. The tough Neoprene jacket assures an exceptionally long service life. It's light in weight; it's virtually immune to the effects of electrolysis, corrosion, and temperature extremes; and it's highly resistant to oils, acids, alkalies, moisture, abrasion, flame and weather.

All in all, this is an ideal 600-volt cable for electric utilities, industrial plants, rural electrification, and airport wiring. And it can often be used as a building wire that will save you money in the long run.

Approved and service proved

RoMarine-RoPrene is specifically approved by Underwriters' Laboratories as Type USE for underground service entrances. And it's approved by the CAA for airport wiring when CAA Specification L-824—with Type A insulation—applies.

Proved superior for general purpose wiring, this cable can be unhesitatingly recommended for 75°C. operation, except in the case of special circumstances specifically described in the National Electrical Code.

To get real economy *and* dependability, specify Rome's power distribution cable—RoMarine-RoPrene—for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 602-B and ask for Bulletin RR-2. Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

Power Corp of Canada Names Three New Executives

Power Corp of Canada, Ltd, has recently appointed James B. Woodyatt chairman of the board, A. Deane Nesbitt president, and P. N. Thompson vice president and general manager.

Woodyatt was formerly vice president and general manager of the corporation before accepting his present post.

Nesbitt graduated from McGill University in 1933 and soon after became associated with the firm of Nesbitt, Thomson & Co, Ltd, investment dealers. During World War II, he served with the First Canadian Fighter Squadron and after discharge rejoined Nesbitt, Thomson & Co, Ltd. He was elected a director in 1947 and president of the company in 1952.

JAMES B. WOODYATT A. DEANE NESBITT P. N. THOMPSON

Thomson joined Investment Secretariat, Ltd, in 1944 after graduation from Sir George Williams College. He is currently a director of the Southern Canada Power Co, Ltd, and the Northern British Columbia Power Co, Ltd

PERSONAL BRIEFS

Duke Power Co has made these promotions: **C. B. Miller, Jr,** assistant supervisor of branches, was named assistant to the president. **D. W. Jones,** manager of Duke's Winston-Salem District, was made assistant supervisor of branches, and **Joseph C. Mason,** Winston-Salem electrical superintendent, has succeeded Jones.

Robert Y. Adams, planning director for the City of Fort Wayne, Ind., has joined American Gas & Electric Service Corp, New York City, as a community planning specialist.

San Diego Gas & Electric Co has named **Lewis R. Kneer** as manager of the newly-formed rates and valuation department.

Oklahoma Gas & Electric Co has made these promotions. **George W. Qualls,** purchasing agent, has been named co-ordinator for the OG&E building program. **Bruce Spence** will replace Qualls and **Shelby H. Cline** will take over Spence's position as assistant purchasing agent.

Wright Canfield, Public Service Co of Oklahoma vice president, has been named co-ordinator for the Tulsa Division with added responsibility for system-wide economic planning.

Virginia Electric & Power Co has made two changes in its engineering department. **Leon D. Johnson, III,** was named chief design engineer and **George C. Mahler,** Blue Ridge district engineer at Charlottesville, was appointed district superintendent there.

George C. Davis, division engineer of Arkansas Power & Light Co, has been promoted to division superintendent, a post vacated by the promotion of **W. R. Patten** to manager of the company's Northeast Division. **Richard E. Stephens** has been advanced from senior distribution engineer to replace Davis.

Illinois Power Co has appointed **A. F. Schultz** as assistant to the president.

Federal Power Commission has elected Commissioner **Frederick Stueck** to serve as vice chairman during the calendar year 1957.

General Electric Co has made these appointments. **Robert W. DeLelys** becomes manager-manufacturing engineer at GE's outdoor lighting department. Company has reorganized its engineering section to establish a product engineering component at each of its four foundries. The new managers of product engineering and their locations are: **J. W. Clarke,** Erie Foundries; **A. B. Steck,** Everett-Lynn Foundries; **R. D. Ahles,** Schenectady Foundries; and **J. T. Coggin,** Elmira Foundries. **Herbert E. Ihrig** has been appointed manager of marketing administration and personnel development for GE's Metallurgical Products Department.

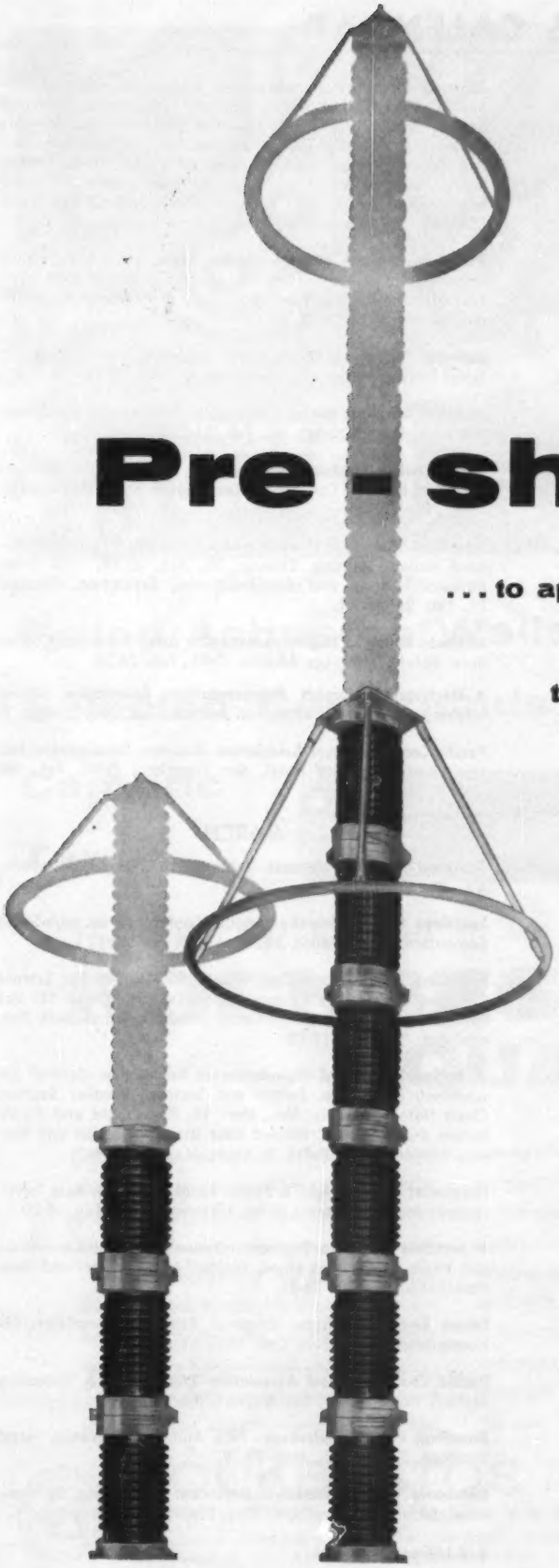
Aluminum Co of America has established a Power Engineering Division within the Engineering Department. It will combine the activities of the Hydraulic Engineering Division and the steam power activities of the Mechanical Engineering Division and will be directed and coordinated by **B. J. Fletcher,** assistant chief engineer.

OBITUARY

Markham Cheever, 76, retired president of Ebasco International Corp, died in New York City recently.

Henry V. Erben, 58, who retired on Nov. 1 as an executive vice president of General Electric Co, died in Schenectady, N. Y., on Dec. 26.

Charles L. Peirce, 73, former board chairman of Hubbard & Co, died in Pittsburgh, Pa., recently.



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... to approximately half-size ...

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the squeeze on available space

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MEETINGS CALENDAR

JANUARY

Doble Engineering Co—24th Annual Conference of Doble Clients, Sheraton-Plaza Hotel, Boston, January 14-18.

Edison Electric Institute—Industrial Relations Committee, sponsored jointly by Personnel Section of Southeastern Electric Exchange, Sheraton-Park Hotel, Washington, D. C., Jan. 17-18; Industrial Power & Heating Group, New Orleans, La., Jan. 17-18.

• **Engineers Joint Council**—General Assembly, Hotel Statler, New York, N. Y., Jan. 17-18.

Atomic Industrial Forum, Inc—Forum Insurance Meeting, Plaza Hotel, New York, N. Y., Jan. 21-22.

American Institute of Electrical Engineers—Winter General Meeting, Hotel Statler, New York, Jan. 21-25.

Pennsylvania Electric Association—Prime Movers Committee, Roosevelt Hotel, Pittsburgh, Pa., Jan. 24-25; Transmission & Distribution Committee, Penn Harris Hotel, Harrisburg, Pa., Jan. 31-Feb. 1; Hydraulic Power Committee, Brunswick Hotel, Lancaster, Pa., Jan. 31-Feb. 1

• **Southwest American Power Dispatchers Association**—Winter Meeting, Phoenix, Ariz., Jan. 26.

• **Canadian Electrical Association**—Eastern Zone Meetings, Quebec, Canada, Jan. 28-31.

American Welding Society—3rd Annual Midwest Welding Conference, Illinois Tech Chemistry Bldg., Chicago, Ill., Jan. 30-31.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, Hotel President, Kansas City, Mo., Jan. 31-Feb. 1.

FEBRUARY

Ninth Annual Industrial Engineering Institute—University of California, simultaneous sessions in Berkeley and Los Angeles, Calif., Feb. 1-2.

National Association of Purchasing Agents—26th Annual Mid-Winter Conference, Public Utility Buyers' Group, Brown Hotel, Louisville, Ky., February 3-5.

Edison Electric Institute—Prime Movers Committee, Deschler Hilton Hotel, Columbus, Ohio, Feb. 4-6; Electrical Space Heating and Air Conditioning Committee, St. Louis, Mo., Feb. 6-8; Transmission & Distribution Committee, Netherland Plaza Hotel, Cincinnati, Ohio, Feb. 7-8; Electrical System & Equipment Committee, Somerset Hotel, Boston, Mass., Feb. 11-12; Residential Lighting Committee, Cincinnati, Ohio, Feb. 11-13; Commercial Cooking & Water Heating Committee, Tutwiler Hotel, Birmingham, Alabama, Feb. 14-15; Residential Promotion Committee, New York, N. Y., Feb. 14-15.

• **American Society for Testing Materials**—Annual Committee Week and Spring Meeting, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 4-8.

Pennsylvania Electric Association—Electrical Equipment Committee, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 7-8; Communications Committee, Hotel Americus, Allentown, Pa., Feb. 11-12; System Planning Committee and Systems Operation Committee, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 14-15; Relay Committee, Roosevelt Hotel, Pittsburgh, Pa., Feb. 28-Mar. 1.

National Electrical Week—Second Annual Observance, Feb. 10-16.

Electric Institute of Washington—Electrical Trade Conference and Exposition, Shoreham Hotel, Washington, D. C., Feb. 12-14.

National Electrical Manufacturers Association—General Purpose Control Subcommittee, Advisory Committee, Industrial Control Section and Industry Control Subcommittee, Advisory Committee, Industrial Control Section, Feb. 13; Electronic Control Subcommittee, Advisory Committee, Industrial Control Section and Standards Committee, Advisory Committee, Industrial Control Section, Feb. 14—all being held at NEMA Headquarters, 155 East 44th St., New York, N. Y.

American Institute of Electrical Engineers—1957 Transistor & Solid State Circuits Conference, sponsored jointly with Institute of Radio Engineers and University of Pennsylvania, Philadelphia, Pa., Feb. 14-15.

National Society of Professional Engineers—Spring Meeting, Hotel Francis Marion, Charleston, S. C., Feb. 15-16.

National Adequate Wiring Conference—13th Annual Discussion, Sherman Hotel, Chicago, Ill., Feb. 21-22.

North Central Electrical League—20th Annual Upper Midwest Electrical Industry Convention, Leamington Hotel, Minneapolis, Minn., Feb. 24-27.

American Society of Heating and Air-Conditioning Engineers—63rd Annual Meeting, Chicago, Ill., Feb. 25-28; 13th International Heating and Air-Conditioning Exposition, Chicago, Ill., Feb. 25-Mar. 1.

Institute of Radio Engineers—Western Joint Computer Conference, Hotel Statler, Los Angeles, Calif., Feb. 26-28.

• **Electrical Equipment Representatives Association**—Annual Meeting, St. Anthony Hotel, San Antonio, Tex., Feb. 27-Mar. 2.

Pacific Coast Electrical Association—Business Development Section, Sheraton-Palace Hotel, San Francisco, Calif., Feb. 28-Mar. 1.

MARCH

Southern Safety Conference—John Marshall Hotel, Richmond, Va., Mar. 3-5.

Louisiana State University—Annual Conference on High-Speed Computers, Baton Rouge, La., Mar. 5-8.

Engineers Joint Council—2nd Nuclear Engineering and Science Conference; 3rd International Atomic Exposition, and 5th Hot Laboratories and Equipment Conference, Convention Hall, Philadelphia, Pa., Mar. 11-15.

• **National Electrical Manufacturers Association**—General Engineering Committee, Switch and Enclosed Breaker Section, Chase Hotel, St. Louis, Mo., Mar. 13; Panelboard and Distribution Board Section, Molded Case Breaker Section and Busway Section, Chase Hotel, St. Louis, Mo., Mar. 14.

Northwest Electric Light & Power Association—Business Development Section, Empress Hotel, Victoria, B. C., Mar. 18-20.

• **Institute of Radio Engineers**—Annual National Convention and Radio Engineering Show, Waldorf-Astoria Hotel and New York Coliseum, Mar. 18-21.

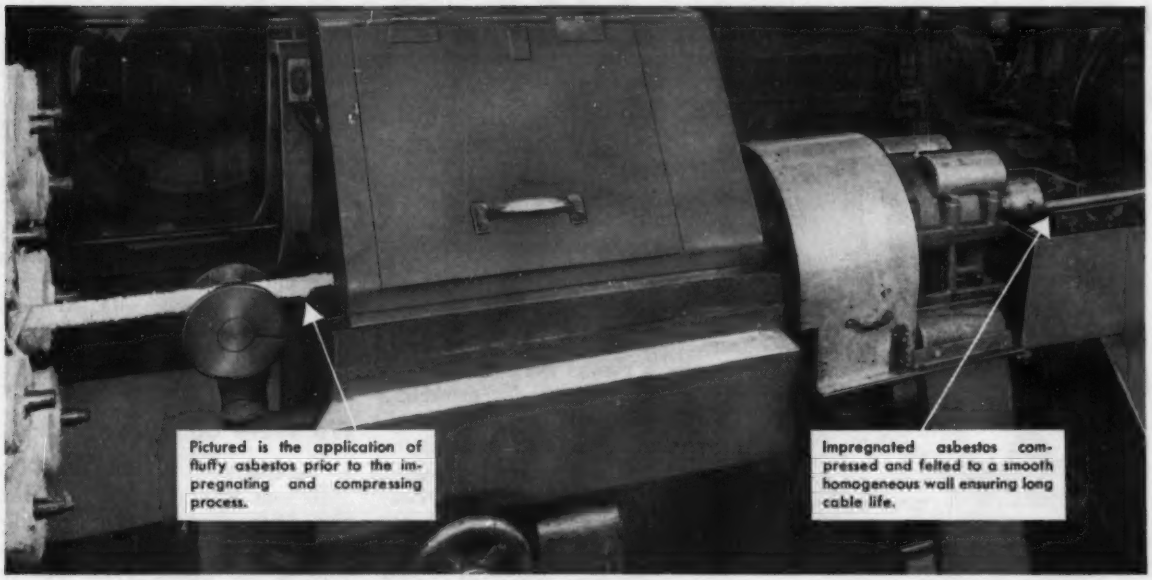
Edison Electric Institute—Industrial Relations Committee, EEI Headquarters, New York City, Mar. 21.

Pacific Coast Electrical Association—Engineering & Operating Section, Hotel Statler, Los Angeles, Mar. 21-22.

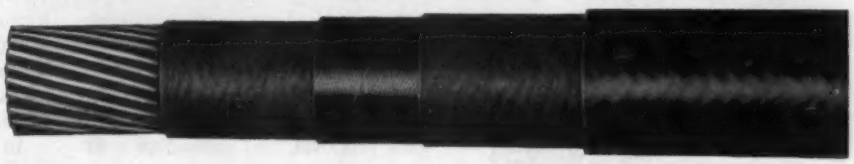
American Power Conference—19th Annual Conference, Hotel Sherman, Chicago, Ill., Mar. 27-29.

Oklahoma Utilities Association—Annual Convention, Biltmore Hotel, Oklahoma City, Okla., Mar. 28-29.

• Additions this week.


Pictured is the application of fluffy asbestos prior to the impregnating and compressing process.
Impregnated asbestos compressed and felted to a smooth homogeneous wall ensuring long cable life.

Felted Asbestos Walls + Impregnation with Selected Compounds + Quality Varnished Cambric Tapes . . .



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READERS FORUM

"PE" Identifies Engineers

To the Editor:

In your editorial of Nov. 12, you suggest that qualified engineers use the designation EE, or ME, or CE, etc, with their names. The intention is fine; however who is to determine what makes an engineer qualified? Also, who is to prevent a person from using designations such as ME for marketing engineer, LE for landscape engineer, and other combinations for various non-technical occupations. The public would become confused with the various combinations of letters that you propose, and before long the idea would lose its meaning.

Without too much investigation you would have found that a method of designation for qualified engineers does exist as set up by the various states. Namely the use of PE by registered professional engineers. One who uses these letters must first prove his qualifications and be registered with the state or states in which he wishes to practice. Here is a legalized method for following the intent of your proposal, and instead of splitting engineering into many categories, it unites us for our common good.

John T. Haller, PE
332 Atlanta Drive
Pittsburgh 28, Pa.

Condensers Important

To the Editor:

In your efforts to do a top notch report on the status of supercritical plants (Dec. 10 issue), you overlooked adequate discussion of the condensers, one of the key components in all the new extremely high pressure plants.

As builders of the condensers for four of the six supercritical plants reported by you and now under construction, I can assure you the research and development required for the new condensers is no less important than that for the other water and steam cycle components. Leak-tight construction, new tube materials, welded tubes and tube sheets, turbine by-pass arrangements, sprayed-on synthetic sealing surfaces and sectionalized hotwells are a few of the changes in design that have kept condenser technology ahead of the problems of tomorrow's supercritical pressure generating units and nuclear plants.

O. A. Hass
Allis-Chalmers Mfg Co.
Milwaukee, Wis.

We Were 60% Correct

To the Editor:

In your story on page 70 of the Nov. 26 issue on the proposed addition of a 450,000-kw generating unit at the Sporn Plant of the American Gas & Electric Co, you say:

"Upon completion of the new unit, the Sporn Plant will have a capability of 1,050,000 kw, making the station one of three in the world to have capacities in excess of 1,000,000 kw. The others, also located on the Ohio River, are the 1,290,000-kw Clifty Creek Plant at Madison, Ind., and the 1,075,000-kw Kyger Creek Plant at Cheshire, Ohio."

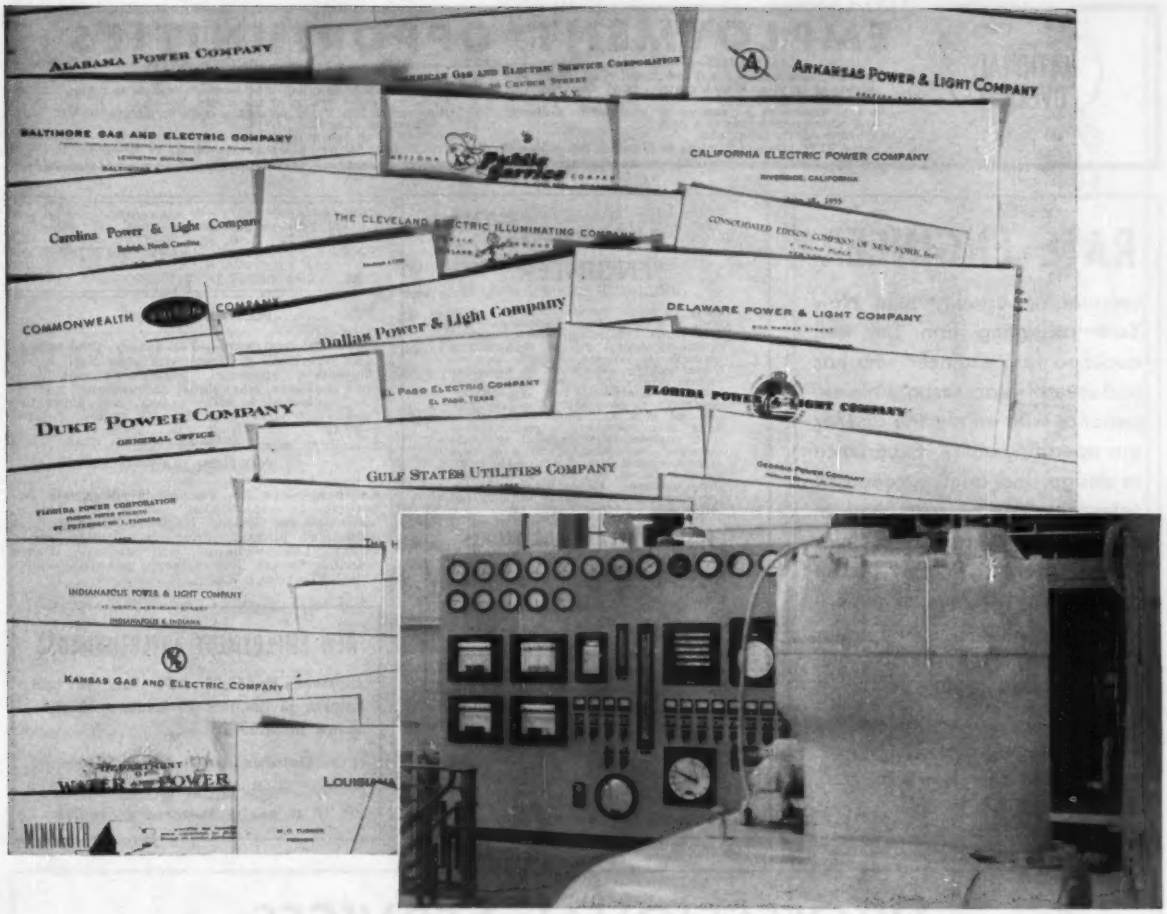
In order to keep the record straight, we believe it should be reported that the new unit will make the Sporn Plant "one of five in the world to have capacities in excess of 1,000,000 kw."

The missing two are TVA's Kingston Plant with a capability of 1,600,000 kw and its Shawnee Plant with a capability of 1,500,000 kw. Moreover, construction is underway which will bring TVA's Johnsonville steam plant to a capability of 1,350,000 kw and its Gallatin Plant to 1,050,000 kw.

Paul L. Evans
Director of Information
Tennessee Valley Authority
Knoxville, Tennessee

Now Appears Weekly

Readers Forum is now a regular weekly feature of the magazine. Contributions are invited.



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You join America's best-known electric power generating companies in your choice of instrumentation by Honeywell. You'll find Honeywell instrumentation everywhere . . . in large stations and small. The reasons for this are clear.

With the precision, stamina, and reliability of Honeywell instruments, you get an important extra . . . service. This service begins with your first plans, and continues long after your instruments are installed. It includes:

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Training of your instrument men in up-to-date maintenance methods at the tuition-free Honeywell Education and Training Center in Philadelphia.

These are but some of the benefits you gain when you add your company's name to the list of prominent companies using Honeywell instrumentation. Get the full story from your nearby Honeywell sales engineer. He's as near as your phone.

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Unusual opportunity with New York consulting firm for well qualified rate engineer who has had several years responsible experience with an electric and/or gas operating utility. Experience in design and administration of rates, analysis of costs and in dealing with regulatory commissions desirable. In reply please give detailed resume of experience, education, personal information, salary expected, etc. Please address replies to

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Large electrical manufacturer of switchgear, unit substations, transmission and distribution switching and protective equipment desires services of apparatus engineer for Atlanta, Georgia location. Duties initially will consist of contacting electric utilities in 4 southeastern states with our established field organization, specifically to do product line sales promotional work on high level engineering basis. Man chosen will be graduate electrical engineer, 30-40 years of age, with successful engineering, operation or sales experience with class of equipment listed. Travel required 60%-70% of the time. Home weekends. Substantial opportunity. Refresher training provided initially and periodically. Address replies to:

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Engineer—age 35, Technical education, experience in supervision, design, installation, operation and Maint. 12 years in utility and industrial plants. Four in public owned utility. Desire change, will relocate, within reason. Desire Supervisory position. PW-3925, Electrical World.

NEW EMPLOYMENT ADVERTISEMENTS

received by 10:00 A.M. Jan. 18 will appear in the Jan. 28 issue, subject to space limitations.

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READERS MAY CONTACT

the consultants whose cards appear on this page with the confidence justified by the offering of these special services NATIONALLY.

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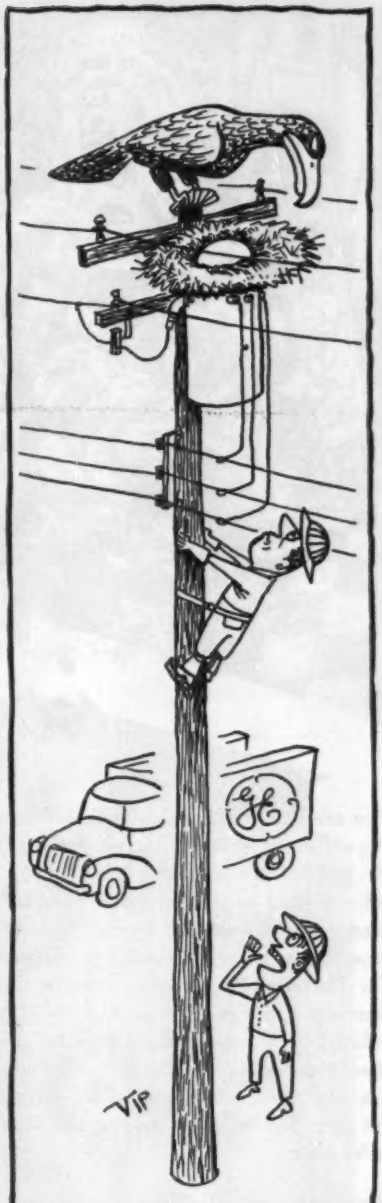

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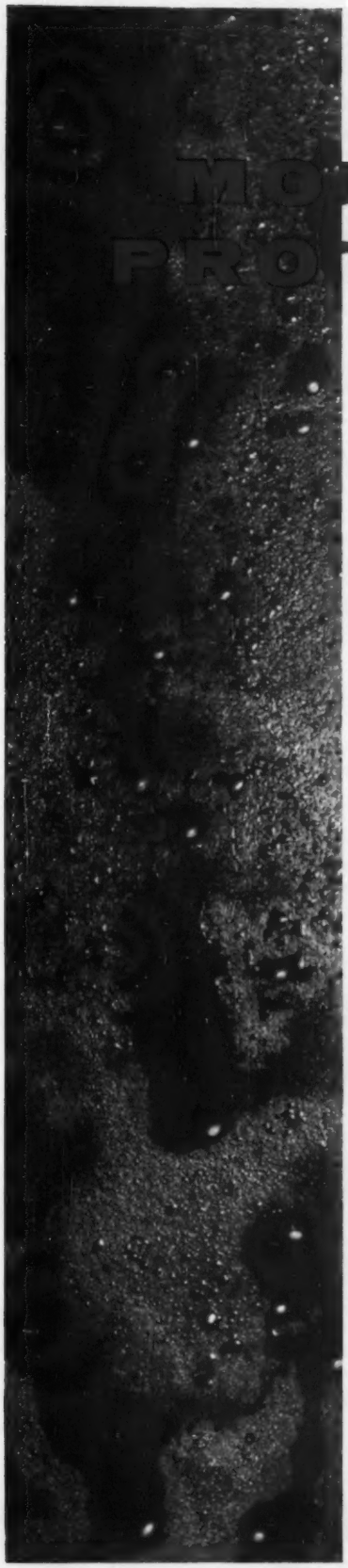

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